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UNTRAINED FORWARD OBSERVER (UFO) TRANSLATOR FOR CALL FOR FIRE

by

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UNTRAINED FORWARD OBSERVER (UFO) TRANSLATOR FOR CALL FOR FIRE

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Many observers need indirect fire but are not proficient in Call for Fire, the procedure used to request indirect fire. To alleviate this, we propose the development of an application, which we call the Untrained Forward Observer (UFO) Translator, capable of assisting untrained observers in performing Call for Fire by asking a series of simple questions to generate a Call for Fire in the proper format. As a prior Forward Observer with more than 12 years of Call for Fire experience, and as a former Supporting Arms instructor at The Basic School in Quantico, VA, the application outlined in this thesis has been carefully designed to ensure the logic in place is sufficient and appropriate to retrieve the required information from users to generate a proper Call for Fire capable of executing a fire mission utilizing indirect fire. A prototype of the application was tested and partially verified in a pilot study conducted at the Naval Postgraduate School and discussed herein. We believe the UFO Translator will fulfill its design specifications and be easy enough to use by any military member, regardless of rank, billet, or experience. In this thesis, we present the design and layout of the UFO Translator.

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LIST OF ACRONYMS AND ABBREVIATIONS

AAR	After Action Review
AF	Adjust Fire
AFATDS	Advanced Field Artillery Tactical Data System
BDA	Battle Damage Assessment
CAS	Close Air Support
CASM	Close Air Support Module
CEOI	Communications Electronics Operating Instructions
CFF	Call for Fire
CFFT	Call for Fire Trainer
COF	Conduct of Fire
COTS	Commercial off the Shelf
de	This Is
DT&E	Developmental Test & Evaluation
EMV	Enhanced Mojave Viper
FDC	Fire Direction Center
FDO	Fire Direction Officer
FFE	Fire for Effect
FO	Forward Observer
FSCC	Fire Support Coordination Center
GPS	Global Positioning System
GUARDFIST	Guard Unit Armory Device Full-Crew Interactive Simulation Trainer
HE	High Explosive
HE/Q	High Explosive / Quick Fuse
HE/VT	High Explosive / Variable Time
HSI	Human Systems Integration
HVT	High Value Target
ICM	Improved Conventional Munitions
I/E	In Effect
I/O	In the Open

MGRS	Military Grid Reference System
MLRS	Multiple Launch Rocket System
ModSAF	Modular Semi-Automated Forces
MOS	Military Occupational Specialty
MOUT	Military Operations in Urban Terrain
MTO	Message to Observer
NPS	Naval Postgraduate School
OT&E	Operational Test & Evaluation
OTM	Open Terrain Module
Q	Quick
ROE	Rules of Engagement
RP	Red Phosphorous
SAVT	Supporting Arms Virtual Trainer
SME	Subject Matter Expert
SOP	Standard Operating Procedures
TGT	Target
TSFO	Training Set Fire Observation
UAS	Unmanned Aircraft System
UAV	Unmanned Aerial Vehicle
USA	United States Army
USAFAS	United States Army Field Artillery School
USMC	United States Marine Corps
UTM	Urban Terrain Module
VBS1	Virtual Battlespace 1
VBS2	Virtual Battlespace 2
VT	Variable Time
WP	White Phosphorous

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I. INTRODUCTION

As an intelligence analyst attached to Marine Unmanned Aerial Vehicle Squadron 1 (VMU-1) in Afghanistan, Staff Sergeant V's mission was to watch live video feeds from Unmanned Aircraft Systems (UASs) displayed on her laptop. Most days, this was tedious and uneventful work, but one day several months into the deployment, Staff Sergeant V noticed some suspicious activity in the vicinity of Kandahar. After taking a closer look, she was able to confirm that these were insurgents emplacing Improvised Explosive Devices (IEDs) in the ground along a well-travelled road.

The small UASs operated by VMU-1 did not carry munitions or have any type of offensive capability, but Staff Sergeant V knew there was an artillery battery within range of the insurgents and decided to request indirect fire. The problem was, Staff Sergeant V was not a trained forward observer and had no idea how to do a Call for Fire, the procedure used to request indirect fire. She contacted the artillery battery, explained to them that she was not a trained observer but had a target of opportunity that she needed to engage, and asked if they could help her with a fire mission. Fortunately, the battery was not over-tasked and the Fire Direction Officer was able to take the time to ask Staff Sergeant V a series of questions that provided him with the information he needed to engage the targets. Several minutes later, steel rain poured from the sky and the insurgents became a non-threat.

Staff Sergeant V's actions on that day may have saved the lives of many U.S. and coalition forces on the ground. However, Staff Sergeant V was lucky that the artillery battery was not busy, the mission was not time-sensitive, and that the Fire Direction Officer knew what questions to ask to gain the information that is normally contained in a proper Call for Fire. In a hectic, combat environment these ideal conditions may not always exist and enemy targets may elude friendly forces, or friendly forces may have to engage with direct fire—an option that places ground forces at great personal risk—rather than with indirect fire.

A. SYSTEM PURPOSE

The primary purpose of the Untrained Forward Observer (UFO) Translator is to assist untrained observers in conducting indirect fire missions using the proper Call for Fire format in combat and non-combat environments. The application is intended to be so easy to use that any military member, regardless of rank, billet, or experience, can use the UFO Translator, and without any prior training in Call for Fire or familiarization with the application itself. As a secondary purpose, the UFO Translator can assist in training personnel how to conduct indirect fire missions more efficiently.

B. PROBLEM STATEMENT

In both the U.S. Army and U.S. Marine Corps, trained Forward Observers currently make up less than 0.2% of the total force (US Marine Corps, 2012; US Army, 2012). Not nearly enough to ensure that every operational unit has a trained FO with them at all times, and sometimes units need indirect fire but lack personnel with the skills necessary to request it.

The Army and the Marine Corps have several training devices (discussed in Chapter II) that help improve the proficiency of FO's, but most of these are not portable, and the ones that are, are too complicated for an untrained observer to use or designed for training only—not for generating an actual operational Call for Fire intended to engage enemy targets. Call for Fire training devices and simulators are great for training military personnel with the Occupational Specialty of Forward Observer. Even non-FO personnel are sometimes exposed to some Call for Fire training, but Calling for Fire is a perishable skill and without consistent practice simple exposure to Call for Fire is not sufficient to enable retention. Therefore, we need a Call for Fire application that can be used on a variety of equipment, from portable devices to desktop computers, and that can assist "untrained" observers perform Call for Fire. A possible solution is the Untrained Forward Observer Translator, designed specifically for the untrained observer with little or no experience with Call for Fire.

C. RELEVANCE TO DEPARTMENT OF DEFENSE

There are currently no systems available to enable an untrained observer to perform Call for Fire. When a unit intends to engage an enemy or is forced to engage an enemy and they have no trained observers, the tendency is to respond with direct fire weapons which can be very costly in lives. When a unit is able to "soften" an objective with indirect fire before sending troops to secure it, the mission is much less risky. The UFO Translator is relevant to the DoD in that it will drastically increase the number of personnel able to request indirect fire (potentially from less than 1% to nearly 100%), which is a force multiplier, increases combat power, and can ultimately save lives.

D. RESEARCH QUESTIONS

This thesis will be guided by the following questions:

- Can a software application be designed to assist untrained observers in performing Call for Fire?
- Can the system be used by any military member, regardless of rank, billet, or experience?
- Will the UFO Translator help untrained observers perform Call for Fire faster than the manual methods?
- Will the UFO Translator help untrained observers perform Call for Fire in a reasonable amount of time comparable to trained observers?

E. SCOPE AND LIMITATIONS

This thesis involves developing the design and layout of a software application that will assist untrained observers in performing Call for Fire—there will not be a fully functional prototype by the end of this thesis. The primary focus of the initial application will be on the operational task of performing a live fire mission using the artillery and mortar Call for Fire procedure. At some point, Naval Gunfire Call for Fire and Close Air Support (CAS) 9-Line briefs should be incorporated into the UFO Translator, but they will not be outlined in this thesis.

The UFO Translator is also not designed to train personnel to perform Call for Fire, although a Training Mode may eventually be embedded with the

application. The UFO Translator is primarily designed for operational use and intended to be simple enough for any military member to use without training on the system itself or prior knowledge of Call for Fire. Ideally, the UFO Translator as a stand-alone system will feature an embedded GPS, compass, and laser-rangefinder to assist the untrained observer with target location. Some or all of these features would not be available on a desktop/laptop computer or on most portable devices such as cell phone apps. For platforms that do not contain the embedded GPS, compass, and laser-rangefinder, the application will walk untrained observers through obtaining the various measures of target location by asking them questions and prompting them to use the equipment they have on hand to gather the location information.

Additionally, since the system is designed for untrained observers, and in order to keep it simple enough to use by anyone, users will be given only three choices as to type of mission to request—Adjust Fire, Fire for Effect, or Immediate Suppression. These three mission types are sufficient to destroy, neutralize, or suppress most targets of opportunity. More advanced mission types, such as Suppression of Enemy Air Defense (SEAD), screening missions, Time on Target (TOT) missions, etc., will not be part of the initial UFO Translator design.

F. THESIS ORGANIZATION

Chapter I discusses the purpose of the Untrained Forward Observer Translator, gives an overview of how it should be used and who can use it, why there is a need for this type of system, what research questions this thesis will answer, the UFO Translator's relevance to the DoD, and the scope and limitations of this thesis. The UFO Translator will be an application that assists untrained observers in performing artillery and mortar Call for Fire. This system is needed because there are currently no systems in the Army or Marine Corps inventory that are specifically designed for untrained observers, and untrained observers often need to use indirect fire. The initial prototype will focus on artillery and mortar operational use only, not training, and will include three types of missions: Adjust Fire, Fire for Effect, and Immediate Suppression.

Chapter II discusses the background of indirect fire, forward observers, and training devises (past and current), gives an in-depth analysis of the Call for Fire procedure, and discusses potential and intended users. As the range of indirect fire weapons has increased throughout the centuries, so has the dependence on Forward Observers to be the “eyes” of the firing agency. Forward Observers use a procedure called Call for Fire to direct weapon systems onto target. Also discussed are the six elements of the Call for Fire, the Message to Observer, adjusting rounds onto target, issuing a Battle Damage Assessment, as well as Immediate Suppression, Fire for Effect, and Adjust Fire missions. And lastly, users of the application are discussed, both potential and intended.

Chapter III discusses specific design elements of the system. The conceptual and visual design of a JavaScript prototype are discussed and its potential to develop into a stand-alone device. The logic of the program is outlined with an example of an Adjust Fire mission.

Chapter IV discusses the development, implementation, and testing of the UFO Translator. First, a pilot study performed at the Naval Postgraduate School is discussed, followed by recommendations for further testing. Once a fully functioning prototype is developed, this chapter explains how an experiment could be conducted to verify and validate the application.

Chapter V contains the conclusion, recommendations, and a discussion on future work. The UFO Translator is scalable and missions such as Naval Gunfire and 9-Line briefs can be added at a later time, as well as a Training Mode for trained and untrained observers, and a Planning Mode for more advanced applications.

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II. BACKGROUND

Indirect Fire is an integral tool in the arsenal of most militaries, particularly in the U.S. Calling for Fire is the preferred method for using indirect fire assets—artillery, mortars, naval gunfire, and air—to destroy, neutralize, or suppress enemy targets. The Call for Fire is used by a Forward Observer, or FO, to direct indirect fire assets onto enemy targets. The FO must be in a position to see the enemy target, whether directly with the naked eye or using a live video feed. When the FO can see the enemy and has gathered the information necessary to do a Call for Fire (target location, target description, method of engagement, etc.), the FO sends this information to the Fire Direction Center (FDC) using a radio or digital device and the FDC directs the guns where to shoot based on the information provided. (In the case of a fire mission using air, the FO would contact the aircraft directly, rather than a Fire Direction Center.) When rounds impact, the FO can make adjustments as necessary to achieve his/her desired results, which is usually to destroy, neutralize, or suppress the target. Once the desired results are achieved, the FO ends the mission and sends a Battle Damage Assessment (BDA).

Indirect Fire can have a decisive impact on a battle or engagement, and so proficiency in Calling for Fire is crucial for timely and accurate fires. There are many ways to use indirect fire, such as Fire for Effect missions, Adjust Fire missions, Suppression of Enemy Air Defense (used when both artillery/mortars and air are available), smoke missions, and illumination missions. And there are many different types of munitions available, such as High Explosive (ground detonating), Variable Time (air burst), Improved Conventional Munitions (armor piercing), Delay fuse (penetrates the ground .05 seconds before it detonates), smoke rounds, illumination rounds, etc.

Indirect Fire can be used in a variety of ways. It can be used to destroy enemy targets; it can be used to prepare an objective area, such as desirable terrain, prior to sending infantry troops to attack; it can be used to screen friendly

actions with smoke; illuminate the night sky during a night attack; mark for aircraft; and a variety of other applications. A single Forward Observer and his radio can have devastating effects on enemy forces, so it is apparent that having proficiency in Call for Fire is important.

A. INDIRECT FIRE IN PREVIOUS CENTURIES

Before the emergence of modern indirect fire assets, such as artillery, air, naval gunfire, and mortars, Forward Observers were not essential for engaging enemy targets. Most indirect fire assets had a short range and the gun crew could engage the enemy and make adjustments from the gun itself, without the need of a Forward Observer. Conducting war today is not so simple. Discussed here is a brief history of indirect fire, and artillery, in particular, because artillery is the ancestor of today's modern indirect fire weapons.

Although not called as such, machines recognizable as artillery have been employed in warfare since antiquity. The first references in the Western historical tradition may be those of the *Hero of Alexandria* circa first century AD/CE, but these devices were widely employed by the Roman Legions in Republican times well before the Christian era (Keegan, 1993). Through much of their early history, artillery was treated as part of the engineering art because the devices were often constructed mostly of local materials whenever needed and not permanently assembled. Until the introduction of gunpowder in Western warfare, artillery depended upon mechanical energy to operate and this severely limited the range and size of projectiles while also requiring the construction of very large apparatus to store sufficient energy (DeVries, 1998).

From the Middle Ages on, the use of artillery became increasingly more important. Bombards were of value mainly in sieges; a famous Turkish example used at the siege of Constantinople in 1453 weighed 19 tons, took 200 men, and 60 oxen to emplace, and could fire just seven times per day (Nicolle, 2008). The Fall of Constantinople was perhaps the first event of supreme importance whose result was determined by the use of artillery when the huge bronze cannons of Mehmed II breached the city's walls, ending the Byzantine Empire (Nicolle, 2008).

During the twentieth century, the industrial revolution resulted in producing long-range weapons, often located tens of miles away from the targets. Although it was possible to hit targets beyond line of sight, effectiveness was not guaranteed. But by using Soldiers whose principle duty was directing artillery fire and close air support (ground attack by aircraft) onto enemy positions, firings became more accurate. In that way, the duty of Forward Observers was created (FM 6-30, 1991).

B. FORWARD OBSERVERS

The Forward Observer's contribution to the outcome of World War I, World War II, and the Korean War, made them very useful in contemporary armies (Walker, 2009). The observer serves as the eyes of the gunners, calling in target locations and adjustments to the Fire Direction Center (FDC) via radio or digital communications tool. The FDC then translates the observer's orders into firing solutions for the battery's cannons. Artillery observers are often deployed with combat arms maneuver units, typically infantry companies or armored squadrons.

On land, artillery observers are considered high-priority targets by enemy forces, as they control a great amount of firepower, are within visual range of the enemy, and are often located deep within enemy territory (FM 6-30, 1991). The artillery observer must be skilled not only in fire direction, but also in stealth, and, if necessary, combat and self-defense.

Forward Observers in the U.S. military are artillery observers who carry the Military Occupational Specialty designator of 13F in the United States Army and 0802 (officer) and 0861 (enlisted) in the United States Marine Corps. They are officially called Fire Support Specialists in the U.S. Army and Forward Observers (officer) and Fire Support Men (enlisted) in the U.S. Marine Corps. They are colloquially known as FiSTers, regardless of whether they are members of a FiST (Fire Support Team), FSE (Fire Support Element), or COLTs (Combat

Observation and Lasing Teams) (FM 6-30, 1991). The Company Fire Support Officer (FSO) is the Officer in Charge of a Fires Support Element.

Forward Observer Officers must be skilled in order to accomplish their demanding duties. They must know artillery methods in direction of fire, use of fire direction instruments such as aiming circles, BC telescopes, and range finders, and they must also be familiar with military maps and their interpretation (FM 6-30, 1991). FOs should have experience with a firing battery and know potentialities and limitations of the particular type of artillery involved, and knowledge of mathematics through trigonometry is desirable but not necessary (FM 6-30, 1991).

C. PAST TRAINING SIMULATORS

A single Forward Observer can have devastating effects on enemy forces, so having proficiency in Call for Fire (CFF) is crucial. Forward Observers are generally positioned at or near enemy lines, which makes their job very risky, so they must be well-trained and skilled in accomplishing their mission.

Training Forward Observers in a live environment presents a wide range of challenges. Indirect fire missions involve a large physical area, as munitions are typically fired at targets several miles away. More importantly, there is a high cost to these exercises as they require not only several rounds of munitions per mission, but also other participants to play roles, including the Fire Direction Center (FDC) and the artillery battery.

The use of a training simulation can alleviate many of these cost factors. Space constraints are reduced to the physical size of the simulation system, while virtual munitions that explode only on a computer screen eliminate the waste and danger associated with live rounds, and also the additional live persons required to fire them. However, such a system does not eliminate the requirement for other interactive participants. For example, a Fire Direction Center must be present to handle the radioed Calls for Fire from the FO. Today, there are simulators which use automated FDCs that are capable of

understanding and processing incoming CFFs, producing doctrinally correct CFF acknowledgements and other required messages, reacting to errors or omissions in CFFs and interacting with the FO to identify them, and implementing received CFFs in a simulated environment (Stensrud, 2006).

Over the past two decades, numerous simulators have been created to help train military personnel. Some simulators, due to their simplicity and vast spectrum of applications, are still used by the U.S. Army and U.S. Marine Corps today. The following is a list of simulators once widely used to train military personnel:

1. Mini Training Set, Fire Observation

The Mini Training Set, Fire Observation (Mini TSFO) was the first artillery Call for Fire simulation designed for a personal computer. It was started in 1985 as an outgrowth of a field artillery officer advanced course battlefield research project at the U.S. Army Field Artillery School (USAFAS) to develop a concept for incorporating PCs into artillery training and completed in 1986. It replaced summer artillery live fire training for cadets at West Point in 1986 and 1987 (Erwin, 1987). The NGF TSFO is the Naval Gunfire version of the TSFO using adapters, actual scenes from San Clemente Island training area, and incorporating effects of dispersion between rounds.

2. Modular Semi-Automated Forces

The Modular Semi-Automated Forces (ModSAF) Call for Fire simulator provides new Army aviators the opportunity to execute Calls for Fire in a modern simulation environment (Binderim, 2003).

3. Virtual Battle Space Systems 1

The Virtual Battle Space Systems 1 (VBS1) concept was initially conceived in 2001, and the first military customer was the United States Marine Corps. It offered realistic battlefield simulations and the ability to operate land, sea, and air vehicles. Instructors could create new scenarios and then run the

simulation from multiple viewpoints. The squad management system enabled users to issue orders to squad members as well as coordinate both lethal and non-lethal tasks. VBS1 allowed free play within scenario-based training missions; it also incorporated simulation of wind, rain, fog, clouds, time of day, sunrise and sunset, and tides (Bohemia, 2002).

VBS1 was based on a commercial game created by Bohemia Interactive Studio. It was designed for federal, state, and local government agencies and can be specifically tailored to meet the individual needs of military, law enforcement, homeland defense, and first responder training environments. VBS1 could be deployed over a LAN or through the Internet on both mobile and desktop computers (Bohemia, 2002).

VBS1 was used to teach doctrine, tactics, techniques, and procedures during squad and platoon offensive, defensive, and patrolling operations. It was also used to teach and rehearse security emergency response procedures in lethal and non-lethal environments. VBS1 delivered a synthetic environment for the practical exercise of the leadership and organizational behavior skills required to successfully execute small unit missions (Bohemia, 2002). Its successor, VBS2, which contains all of the same capabilities as VBS1 but with a few enhancements and a faster processing speed, was officially launched in 2007 and is widely used by the U.S. Army.

4. Guard Unit Armory Device Full-Crew Interactive Simulation Trainer II

Guard Unit Armory Device Full-Crew Interactive Simulation Trainer II (GUARDFIST II) was initially used by both U.S. Active Duty Army and Army Reserve. It was a transportable training system that provided simulated battlefield scenarios for the training of field artillery Forward Observers (FOs). There were three versions of the system: (1) The one-to-one (1:1) version where one instructor trained one FO; (2) the one-to-four (1:4) version where one

instructor trained four students; and (3) the one-to-thirty (1:30) version where one instructor trained 30 students using a wide screen display (McDonough, 2005).

Currently, GUARDFIST II is used by the National Guard and is still a transportable procedural training system that utilizes simulated battlefield scenarios to provide sustainment training for field artillery FOs and to exercise Fire Direction Specialists. It is a computer-based simulator that projects images of various impact areas, and then targets are superimposed on the image and Soldiers practice Calls for Fire. Round impact is shown on the screen and Soldiers adjust fire using standard fire commands. The system will accept grid, polar, and shift missions. In addition to standard Suppression and Fire for Effect missions, Soldiers can also practice smoke and illumination missions (Minnesota, 2013).

D. CURRENT TRAINING SIMULATORS

Fort Sill, OK, is the home of the Fires Center of Excellence and the home of Field Artillery where Soldiers and Marines go to learn their craft of Supporting Arms and Call for Fire. Some of the trainers used at Fort Sill and at other military bases over the years include the Training Set Fire Observation (TSFO), GUARDFIST, Call-For-Fire Trainer (CFFT), and the Supporting Arms Virtual Trainer (SAVT). All of these simulators/trainers are able to perform fire missions using grid, polar, and shift from a known point. Some of the newest simulators like CFFT and SAVT are able to perform Close Air Support (CAS) training as well. Currently, only Fire Support Specialists and Forward Observers receive formal CFF and CAS training that is simulated in the trainers mentioned above. Many Marines and Soldiers that use Call for Fire in operational environments do not receive any formal training.

1. Training Set Fire Observation

The Training Set Fire Observation (TSFO) has been in the USMC inventory since 1985 and can be found on several installations throughout the Marine Corps, but is most used to train newly commissioned officers and warrant officers at The Basic School in Quantico, VA (McDonough, 2005). The TSFO can

be used for exercise planning as well as basic and advanced map reading. It can simulate the effects of four 6-gun artillery batteries equipped with 155-mm howitzers and a barrage of munitions including High Explosive with either Quick, Variable Time, Time, or Delay Fuses; Improved Conventional Munitions (ICM); White Phosphorous (WP); and Illumination rounds. The terrain is projected onto a large screen along with randomly projected enemy targets. Sound effects, such as enemy vehicles, enemy weapons fire, artillery rounds-in-air, and artillery rounds-impact, accompany each fire mission. The TSFO is also capable of simulating both day and night conditions (FM 6-30, 1991).

2. Call for Fire Trainer

The Call for Fire Trainer (CFFT) is currently being fielded at Fort Sill, OK, and is able to enhance the warfighters training experience by allowing the Forward Observer to not only practice traditional Call for Fire missions, but CAS missions as well (PM STS, 2012). The CFFT comes in three flavors: 1:4, 1:12, and 1:30 instructor to student ratios. The first two models are easily transportable and can be utilized for training in less than 20 minutes. The CFFT incorporates the Army's OneSAF constructive simulation, which can be used as a force generation tool capable of generating any friend, foe, or neutral force in the simulation. The CFFT utilizes real tools, such as the laser range finder and laser designator. The CFFT II PLUS, a follow-on to the existing CFFT system, incorporates use of the following modules for training (PM STS, 2012):

- Open Terrain Module (OTM) for outdoor, rural scenarios.
- Urban Terrain Module (UTM) for generic, urban terrain scenarios.
- Close Air Support Module (CASM) for CAS techniques.
- Fires and Effects Command Module for fires chain of command coordination.
- After Action Review (AAR) Module for enhanced learning/training.

3. Supporting Arms Virtual Trainer

The Supporting Arms Virtual Trainer (SAVT) is one of the newest tools in use by Forward Observers in the Marine Corps. The first generation SAVT was unveiled on November 03, 2011 at Camp Hansen, Okinawa, Japan. This trainer allows traditional CFF and CAS training to be performed without the use of real projectiles. There are three methods that the student can simulate. They are: 1) Forward Air Station, 2) Observation-Post Station, and 3) Forward Air Control (Bilbruck, 2012). The scenarios are projected onto a 15 ft. high x 10 ft. wide radius dome screen. This gives the trainee an impressive 260-degree horizontal and 60-degree vertical field-of-view image. This makes it somewhat more immersive than the flat screens used on the aforementioned trainers. Two student teams can simultaneously communicate to aircraft and the gun line for Battle Damage Assessments, effects on target, and adjustments of fires (Bilbruck, 2012).

4. Virtual Battlespace 2

There is a Call for Fire module for the Virtual Battlespace 2 (VBS2) system that simulates artillery, mortars, Multiple Launch Rocket System (MLRS), and Naval Gunfire with a high level of detail. CFF missions can be simulated along with accurate ballistic modeling (PM ACTT, 2012).

5. Summary

This section has discussed the variety of simulators and trainers that are available to help Forward Observers improve their skills and practice their craft, but there are still currently no systems available to assist untrained observers in performing Call for Fire. An application is needed that can fill this gap, and the UFO Translator is a possible solution.

The rest of this chapter gives a background on Call for Fire procedures. This chapter is not all-inclusive, but focuses on the missions performed by the UFO Translator. In particular, Adjust Fire, Fire for Effect, and Immediate

Suppression missions are covered, as well as the Grid and Polar methods of target location. A basic understanding of doctrinal Call for Fire procedures is important for understanding the design of the UFO Translator discussed in Chapter III.

E. WHAT IS CALL FOR FIRE?

A Call for Fire (CFF) is a request for fire from an observer to the Fire Direction Center (FDC) of an indirect firing agency (artillery, mortars, or naval gunfire) that contains all the information needed by the FDC to engage the intended target(s). As it is a request, a Call for Fire can be denied if the Fire Support Coordination Center (FSCC) determines the impact of the rounds will place friendly forces in danger or if a higher priority observer is utilizing the firing agency at the time of the request. In either case, the FSCC will notify the observer that his or her mission has been denied and the reason why. If the environment that caused the denial changes, the observer may re-submit the Call for Fire. The denial of a mission that does not involve a safety issue is very rare. The FSCC and the FDC make every effort to approve and accommodate all appropriate requests for fire.

Calls for Fire can be sent to the Fire Direction Center either by voice over a radio utilizing the Conduct of Fire (COF) net, or through a digital device such as the StrikeLink or Advanced Field Artillery Tactical Data System (AFATDS). If sent by voice, the request should be spoken clearly but quickly and the observer should listen carefully to ensure the FDC reads back the information correctly. If the FDC reads back a piece of information incorrectly, the observer must say, “Correction,” and re-send the entire transmission to the FDC, even if only one part of the transmission was incorrect. If the observer does not understand something said by the FDC over the radio, he or she should say, “Say Again, over,” rather than “Repeat.” In artillery, mortars, and naval gunfire, the term “repeat” is reserved for the re-firing of rounds. A diagram of the Call for Fire process is shown below.

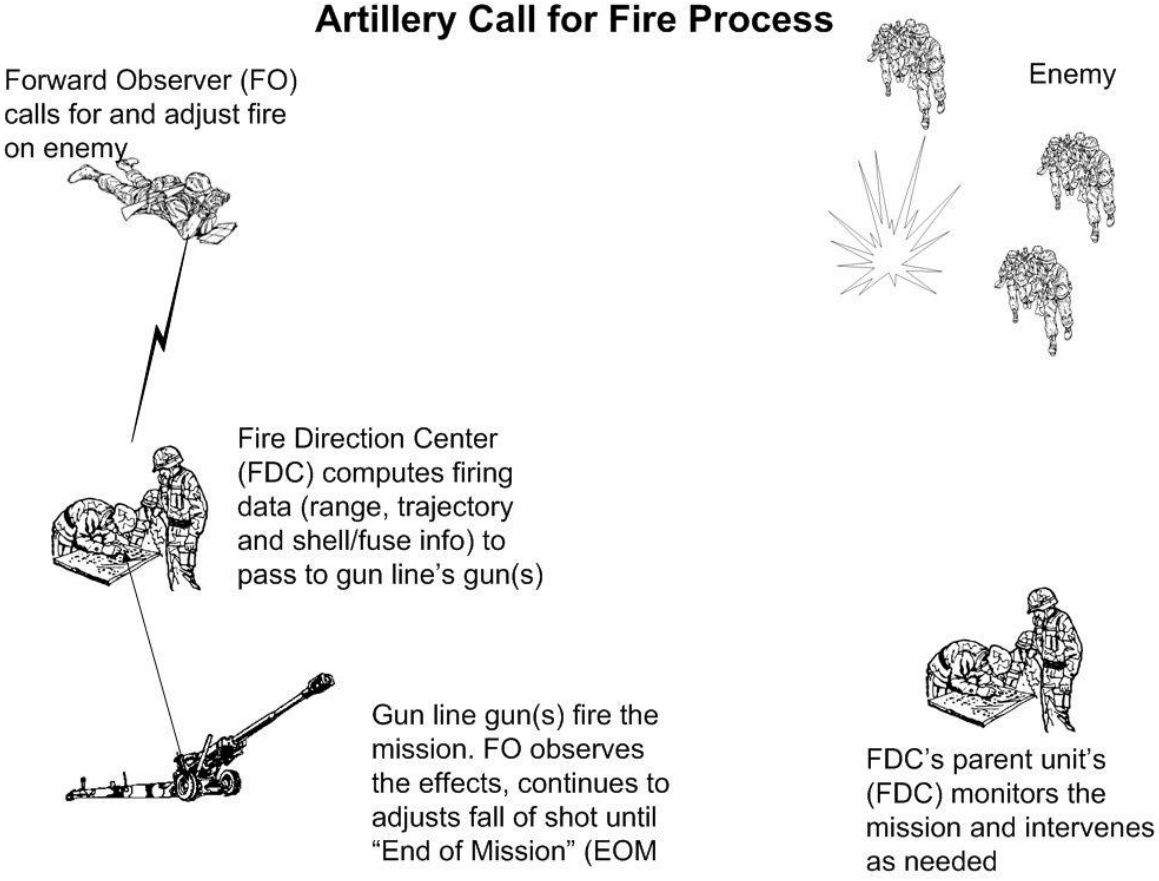

Figure 1. Call for Fire Process (From commons.wikimedia.org).

The Untrained Forward Observer (UFO) Translator will allow users to request one of three different types of missions—Immediate Suppression, Fire for Effect, or Adjust Fire. In order to understand the differences between these types of missions, we must first discuss the six elements of the Call for Fire, the Message to Observer (MTO), and the Battle Damage Assessment (BDA).

F. SIX ELEMENTS OF THE CALL FOR FIRE

There are six basic elements, described below, that make up the Call for Fire: The Observer Identification, Warning Order, Target Location, Target Description, Method of Engagement, and Method of Fire and Control. In an Immediate Suppression mission, the last three elements are omitted to save time and the first three elements are sent in a single transmission, as shown in Table 1.

First Transmission:	(1) Observer ID, (2) Warning Order, and (3) Target Location

Table 1. Elements of an Immediate Suppression.

For other types of missions, all six elements are used and sent in three separate transmissions, as shown in Table 2.

First Transmission:	(1) Observer ID and (2) Warning Order
Second Transmission:	(3) Target Location
Third Transmission:	(4) Target Description, (5) Method of Engagement, and (6) Method of Fire and Control

Table 2. Elements of other missions.

1. Observer Identification

The first element of the Call for Fire is the Observer Identification, or Observer ID. This element consists of both the FDC's callsign and the observer's callsign, which can be found in the Communications Electronics Operating Instructions (CEOI). For example, "O1T de W2C…." In this example, "O1T" (pronounced "Oscar One Tango") is the FDC's callsign; "de" stands for "this is;" and "W2C" (pronounced "Whisky Two Charlie") is the observer's callsign.

2. Warning Order

The second element of the Call for Fire is the Warning Order. The Warning Order tells the FDC the type of mission and the type of target location that will be used. For the UFO Translator, *Adjust Fire, Fire for Effect*, and

Immediate Suppression are the only three types of missions made available to the user, and *Grid* and *Polar* are the only types of target location. For example, "…Adjust Fire, polar, over." In this example, "Adjust Fire" is the type of mission and "polar" is the type of target location the observer plans to use. If the user prefers to do a grid mission rather than polar, this part of the Warning Order can be left blank because grid is the standard method of target location.

3. Target Location

The third element of the Call for Fire is Target Location. By sending the Target Location to the FDC, they can convert the information into firing data for the howitzers or mortars. For example, if "polar" was announced in the Warning Order, then the Target Location transmission might look like this: "Direction 1650, Distance 2800, over," where "1650" (pronounced "one six five zero") is the direction from the observer to the target in mils grid (a "mil" is a unit of measure commonly used in artillery; there are 6400 mils in a circle, or approximately 17.8 mils in one degree). Mils grid is standard; if using mils magnetic, degrees grid, or degrees magnetic, the observer must specifically state this in the transmission. All military lensatic compasses (lensatic refers to the non-direct optical sight on the compass) give direction in both mils and degrees: Mils are the black numbers on the outer ring of the compass and degrees are the red numbers on the inner ring. The next value, "2800," (pronounced "two eight hundred") is the distance from the observer to the target in meters (if using a measurement other than meters, it must be specifically stated).

If nothing was announced in the Warning Order, the FDC is expecting to hear a six or eight digit grid. For example, "Grid 452 397, over," providing an east-north off-set from the grid corner reference. When giving a six-digit grid (accurate to within 100 meters), there should be a pause after the third number; when giving an eight-digit grid (accurate to within 10 meters), there should be a pause after the fourth number. Ten-digit grids are never used for area fire weapons.

4. Target Description

The fourth element of the Call for Fire is Target Description. The Target Description is important because it helps the FDC decide what type of munition(s) to use on the target. Munitions consist of a projectile and fuse. Table 3 lists common projectiles and Table 4 lists common fuses found in standard artillery batteries and mortar platoons.

High Explosive (HE):	The standard projectile, point-detonating.
Illumination:	Normally used to illuminate the target area, but can also be used on the deck to mark for aircraft.
Improved Conventional Munitions (ICM):	This is an armor-piercing projectile that explodes in the air and drops 88 grenade bomblets.
Smoke:	White Phosphorous (artillery) and Red Phosphorous (mortars) smoke rounds are used for screening or marking.

Table 3. Projectiles.

Quick:	The standard fuse used with HE.
Time:	Used with Illumination, ICM, and Smoke, but is standard and does not need to be requested.
Variable Time:	Generally used with HE to create an air-burst.

Table 4. Fuses.

The High Explosive projectile used with a Quick fuse (HE/Q) is the standard round used for adjustment—one HE/Q round is fired at a time until the observer achieves effects on target and declares “Fire for Effect.” When “Fire for Effect” is sent, the shell/fuse combination chosen by the Fire Direction Center to achieve maximum effects on the target(s) is used.

The Target Description contains four elements: The number/size of the target(s); the type of target; the target activity; and the target’s degree of protection. Generally, only the type, size, and degree of protection are sent. For

the UFO Translator, there will be drop down menus to help the user decide what to choose. For Target Type, the user will be able to choose one of the following options: *Personnel, Armored Vehicle(s), Unarmored Vehicle(s), Aircraft on Ground, Fuel Site, Assembly Area,* or *Other;* for Number of Targets, a number pad will appear to allow the user to type the number; and for Degree of Protection, another drop down menu will appear with the following options: *In the Open, In Trenches, Overhead Cover, In Building(s),* or *Other*.

For example, “Two T-72 Tanks in the open, over” or “Squad of infantry in trenches, over.” In these examples, “two” and “squad” are the size; “T-72 Tanks” and “infantry” are the type; and “in the open” and “in trenches” are the degrees of protection.

5. Method of Engagement

The fifth element of the Call for Fire is Method of Engagement, which is optional; the observer can choose how he or she wants to attack the target in this method or let the FDC decide the method of attack. The five elements of the Method of Engagement include:

Type of Engagement:	The two types of engagement are Area Fire (standard without request) and Precision Fire.
Danger Close:	The observer will announce “Danger Close” in the Method of Engagement if there are friendlies within 600 meters of the target (800 meters for mortars).
Mark:	The observer can announce “MARK” if they wish to orient themselves to the impact area or indicate targets to ground forces or aircraft.
Trajectory:	The two types of trajectory are Low Angle (standard without request) and High Angle.
Ammunition:	The observer can also request what shell/fuse combination he or she would like to use on the target in the Fire for Effect phase of the mission, the volume of fire desired from each howitzer (or mortar tube), as well as the distribution of the rounds—a circular sheaf is standard, but linear or rectangular sheafs can be requested.

Table 5. Five elements of the Method of Engagement.

6. Method of Fire and Control

The sixth element of the Call for Fire is Method of Fire and Control, which is also optional; the observer can choose the manner in which he or she wants to engage the target or let the FDC decide. The eight elements of the Method of Fire and Control include:

When Ready:	This is standard and does not need to be announced.
At My Command:	This is announced when the observer wishes to control when the rounds are fired.
Cannot Observe:	This lets the FDC know the observer will not see the impact of the rounds.
Time on Target:	Used when the observer wants the rounds to land on the deck at a specific time.
Continuous Illumination:	The FDC will fire illumination at specific intervals to keep the impact area illuminated.
Coordinated Illumination:	The observer will determine when the illumination is fired.
Cease Loading:	Directs the firing line to load no more rounds, but they are authorized to fire any rounds still in the tubes.
Check Firing:	All firing must stop immediately.

Table 6. Eight elements of the Method of Fire and Control.

G. MESSAGE TO OBSERVER

When requesting any type of mission other than “Immediate Suppression,” the observer will receive a “Message to Observer” (MTO) from the FDC containing information pertinent to the mission. The FDC sends the MTO to the observer after the third transmission of the CFF, and before the first round is fired. The elements of the Message to Observer include:

Unit Firing:	The battery (or batteries) firing the requested rounds, indicated by the last letter of the unit's callsign.
Number of Rounds:	The number of rounds each tube will fire in the Fire for Effect phase of the mission. A standard artillery battery has six howitzers.
Changes:	Any changes made to the initial Call for Fire are stated here. For example, if the observer requested a type of round that is not in the battery's inventory, the FDC will state here what type of round will be fired instead.
Target Number:	Every mission is assigned a target number, which usually contains two letters and four numbers (ex. AB1003).

Table 7. Four elements of the Message to Observer.

Here is an example Message to Observer: "T, 3 rounds, HE, TGT# AA1000, over." In this example, "T" (pronounced "Tango") is the last letter of the callsign of the tasked battery; "3 rounds" is the number of rounds per tube that will be fired in the Fire for Effect phase of the mission—in a normal 6-gun artillery battery, this would be 18 rounds; "HE" indicates that the munition the observer requested is not available and HE will be fired instead; "TGT# AA1000" (pronounced "target number alpha alpha one-thousand") is the target number for this mission.

H. ADJUSTMENTS

During an Adjust Fire mission, or if the rounds did not have the desired effect in an Immediate Suppression or Fire for Effect mission, it may be necessary to make adjustments to the round(s) until the desired effects are achieved. In a standard Adjust Fire mission, one round is fired at a time (usually HE/Q) until the observer announces "Fire for Effect, over." In order to request Fire for Effect, one of the following three criteria should be achieved: (1) Effects on target; (2) the 100 meter range bracket is "broken" (breaking the 100-meter bracket is explained below); or (3) a round lands "range correct."

1. Spottings

Shortly after the observer sends the Call for Fire to the FDC and the FDC sends the Message to Observer to the observer, the FDC will announce “shot, over” and the observer should immediately respond “shot, out.” The observer should be ready with his or her binoculars to spot where the round lands in relation to the target. Once the round lands, the observer must make a quick deviation and range “spotting” before the smoke from the round dissipates. The observer will first make a range spotting and determine if the round landed over, short, or range correct of the target. At times it is easy to determine the range spotting, but it may be helpful to the observer to put the center of the reticle pattern of the binoculars on the target and then check to see if the round landed over, short, or range correct of the horizontal reticle pattern. As shown in the figure below, the round landed over the reticle pattern, so the range spotting is “over.”

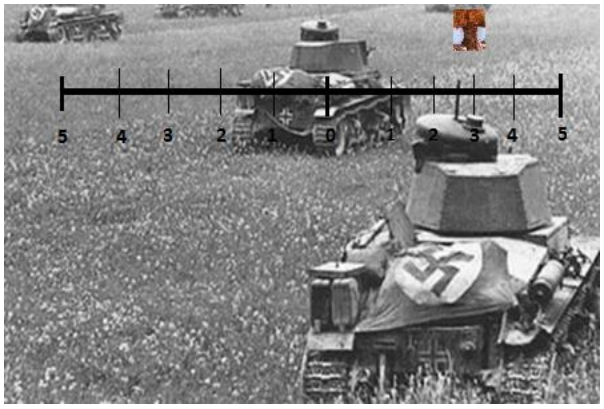

Figure 2. Range and Deviation spotting (From http://percipere.typepad.com).

After the range spotting, the observer must make a deviation spotting. The round will land either left, right, or on-line with the target. Again, the reticle pattern in the binoculars will help the observer make this spotting. If spotted to the left or right, the observer should also spot how far to the left or right by counting the number of tic marks. In the reticle pattern of the binoculars, each number represents ten mils; so 1 = 10 mils; 2 = 20 mils; 3 = 30 mils; etc. In Figure 2

above, we see that the deviation spotting is “right, 30” (pronounced “right, three zero”). Mils is understood and does not need to be written down.

The entire range and deviation spotting in this example is “over, right 30.” It is important that the observer make this spotting quickly and write it down before the smoke from the impact dissipates. The spotting, however, is not sent to the FDC. Once written down, the observer can work on converting the spotting into a correction that will then be sent to the FDC.

2. Corrections

Spottings are what the observe records for himself or herself, but the correction is what is sent to the Fire Direction Center. A correction is sent in the exact opposite order of the spotting—deviation first and then range. In order to convert a spotting into a correction, the observer must first figure out the Observer to Target Factor (OT Factor).

The OT Factor will help the observer make a deviation spotting. The OT Factor is determined by dividing the range to the target by 1000 and then *expressing* (similar to rounding) the number to the nearest whole number. The only difference between expressing and rounding is if the OT Factor ends in point five (.5) after dividing by 1000, then the observer will round to the nearest even whole number rather than just rounding up. For example, if the range to the target was 3500 (meters), 3500 divided by 1000 = 3.5, and 3.5 expresses (and rounds) to 4; so the OT factor is 4. If the range was 2500, 2500 divided by 1000 = 2.5, and 2.5 expresses (but does not round) to 2; so the OT factor is 2. But we only use artillery expression if the number ends in .5; any other number will round up or down to the nearest whole number. For example, a range of 4600, divided by 1000 = 4.6, expresses to 5; a range of 4400, divided by 1000 = 4.4, expresses to 4. And as we learned above, a range of 4500 divided by 1000 = 4.5, would express to 4.

Once we figure out the OT Factor, we can then determine the deviation correction. The deviation correction is the deviation spotting (in mils) multiplied by

the OT Factor and this gives us the deviation correction in meters. For example, if the OT factor is 3, using the initial spotting example of “over, right 30,” we multiply 30 by 3 and our deviation correction is “Left 90.” Notice that since our spotting was “right,” our correction is “left;” if the round lands to the right of the target, we want to move it left toward the target and vice versa. It is important to note that since artillery and mortars are area fire weapons, any deviation correction of less than 30 (meters) should be omitted to save time.

Range corrections are much easier than deviation corrections because we want to establish a bracket. A bracket means we want one round over and one round short of the target. The standard range correction is add or drop 400 (meters); in the example above where the spotting was “over,” we would say “drop 400.” If the observer thinks 400 will not be enough, he or she can add or drop 800; if the observer thinks 400 is too much, he or she can add or drop 200—but only experienced observers should start with a 200 meter bracket because range can be very deceiving. Once a bracket is established, the observer can then start cutting his or her range corrections in half until they “break” the 100-meter bracket; breaking the 100-meter bracket means adding or dropping 50. For example, if our first round landed “over,” our first range correction will be “drop 400.” As long as the next round lands short of the target, we can begin cutting the corrections in half. If the second round does not land short of the target, however, we must continue to drop 400 until a bracket is established. Assuming our second round landed short, our second correction will be “add 200.” After that, if the round lands short, we say “add 100” and if the round lands over we say “drop 100.” Notice once the bracket is established, we can continue to cut the corrections in half regardless if the round lands over or short. After we add or drop 100, our next correction would be “add 50, FFE, over” or “drop 50, FFE, over” (pronounced “add (or drop) five zero, fire for effect, over”). If at any time the observer spots the round as “range correct” before breaking the 100-meter bracket, he or she can make any necessary deviation

corrections and Fire for Effect. To see an example of an adjust fire mission from beginning to end, please see section L of this chapter.

3. What if I do not have binoculars with a reticle pattern?

Deviation corrections can be difficult to make without the use of binoculars with a reticle pattern, but there is a reliable way of determining deviation spottings using the Finger Method. If an observer has no binoculars, they can stick out their hand at arms-length, and measure the distance between the round's impact and the target using the following criteria:

- One finger = 30 mils
- Two fingers = 70 mils
- Three fingers = 100 mils
- Four fingers = 125 mils
- Fist from knuckle to knuckle = 180 mils
- Outstretched hand from pinky to thumb = 300 mils

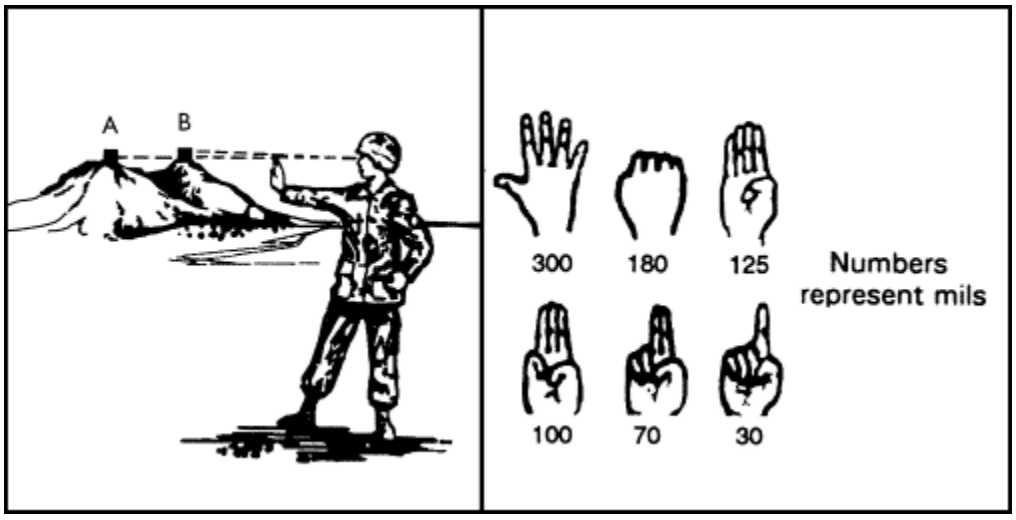

Figure 3. Determining mils with the Finger Method (From FM 17–15).

Once the deviation spotting has been determined using the Finger Method, it can be converted into a correction the same way as a deviation spotting with binoculars—by multiplying it by the OT Factor.

I. BATTLE DAMAGE ASSESSMENT

Once the Call for Fire has been sent, the Message to Observer has been received, the rounds have been adjusted, and the observer has called “Fire for Effect,” the FDC will expect a Battle Damage Assessment (BDA), sometimes called the “End of Mission Statement” (unless an Immediate Suppression mission was conducted). There are four elements to the End of Mission Statement and a handy acronym to help the observer remember what they are: RREMS. RREMS stands for (1) Refinement (optional), (2) Record as Target (optional), (3) End of Mission, and (4) Surveillance (note the “E” and the “M” go together in the “End of Mission” element).

1. Refinement

This element is optional and should only be sent if the observer plans to record as target. If the observer intends to record as target, then any minor deviation and range corrections to move the center of the Fire for Effect rounds to the center of the target can be made here. In Refinement, the minimum 30 meter deviation and 50 meter range corrections do not apply; a deviation and range correction of any amount can be made. For example, “right 15, add 20” (pronounced “right one five, add two zero).

2. Record as Target

This element is optional and should only be sent if the observer plans to save the fire mission within the Advanced Field Artillery Tactical Data System (AFATDS). If the observer intends to save the event, then at this point in the RREMS statement, the observer states “Record as Target.” The FDC will save this mission in the AFATDS using the target number assigned to the mission in the Message to Observer.

3. End of Mission

Whether the observer records as target or not, he or she must always state “End of Mission.” This announces to the FDC that this is the last transmission of the fire mission and that a “Surveillance” is forthcoming.

4. Surveillance

Surveillance has two parts: (1) What happened to the target (destroyed, neutralized, or suppressed), and (2) the estimated number of casualties. For example, “2 tanks destroyed, estimate 4 casualties, over.”

The following are examples of the RREMS statement with and without recording as target, respectively:

“Left 10, drop 35, Record as Target, End of Mission, three BMPs neutralized, estimate seven casualties, over.”
“Right 15, add 40, Record as Target, End of Mission, assembly area destroyed, estimate 50 casualties, over.”
“Left 20, add 30, Record as Target, End of Mission, machine gun bunker suppressed, estimate two casualties, over.”

Table 8. Example RREMS statements with “Record as Target.”

“End of Mission, four T-72 tanks destroyed, estimate six casualties, over.”
“End of Mission, two ZSU 23-4’s suppressed, estimate two casualties, over.”
“End of Mission, troops neutralized, estimate 60 casualties, over.”

Table 9. Example RREMS statements without “Record as Target.”

J. IMMEDIATE SUPPRESSION

The Immediate Suppression mission is used when indirect fire is needed immediately to suppress an enemy target that is firing on friendly forces or is considered a High Value Target (HVT). Since rounds are needed immediately, the Call for Fire is sent in one continuous transmission and contains only the first three elements of the Call for Fire discussed above: Observer ID, Warning Order, and Target Location. For example: “T1D de M5V, Immediate Suppression, Grid 452 883, over” calls for immediate rounds on grid-point-off-set 452 883.

Once the FDC has received this information, they will work quickly to send a standard number of rounds (generally three rounds of HE/Q per tube) onto the

target. Once the first round is fired, the FDC will announce “Shot, over” to the observer on the radio, and the observer will acknowledge with “Shot, out.” Once the last round has been fired, the FDC will announce “Rounds Complete, over” to the observer, and the observer will acknowledge with “Rounds Complete, out.” Since Immediate Suppression missions are self-ending, no further communication is required between the FDC and observer. If the rounds did not have the desired effect on the target, then the observer can make a correction and state “repeat, over.” Another option available is to transition from an Immediate Suppression mission into an Adjust Fire mission to further neutralize or destroy the target that was just suppressed.

K. FIRE FOR EFFECT

Fire for Effect missions are used when the observer is confident about the target location and time is not an issue. Unlike the Immediate Suppression mission, Fire for Effect and Adjust Fire missions are sent in three transmissions and contain all six elements of the Call for Fire as follows:

First Transmission:	(1) Observer ID and (2) Warning Order.
Second Transmission:	(3) Target Location.
Third Transmission:	(4) Target Description, (5) Method of Engagement (optional), and (6) Method of Fire and Control (optional).

Table 10. Elements of Fire for Effect and Adjust Fire missions.

The following tables show examples of Fire for Effect missions.

Observer:	N3K de O2F, Fire for Effect, Polar, over
FDC:	O2F de N3K, Fire for Effect, Polar, out
Observer:	Direction 2350, Distance 3400, over
FDC:	Direction 2350, Distance 3400, out
Observer:	3 BMP's in the open, ICM, over
FDC:	3 BMP's in the open, ICM, out

Table 11. Example Fire for Effect Call for Fire.

FDC:	Message to Observer, T, 3 rounds, TGT # AA1003, over
Observer:	Message to Observer, T, 3 rounds, TGT # AA1003, out
FDC:	Shot, over
Observer:	Shot, out
FDC:	Rounds Complete, over
Observer:	Rounds Complete, out

Table 12. Example Fire for Effect Message to Observer and firing of rounds.

Observer:	End of Mission, 3 BMPs destroyed, estimate 5 casualties, over
FDC:	End of Mission, 3 BMPs destroyed, estimate 5 casualties, out

Table 13. Example Fire for Effect Battle Damage Assessment.

L. ADJUST FIRE

Adjust Fire missions are used when the observer is not confident about the target location and time is not an issue. Like the Fire for Effect mission, Adjust Fire missions are sent in three transmissions and contain all six elements of the Call for Fire as shown above in Table 10.

One main difference between this type of mission and Fire for Effect missions is that, in an Adjust Fire mission, the FDC will fire only one round at a

time until the observer requests “Fire for Effect.” The observer will adjust each round onto the target until he or she achieves effects on target, a Range Correct spotting, or has broken the 100-meter bracket. The following tables give an example.

Observer:	D2W de A1C, Adjust Fire, over
FDC:	A1C de D2W, Adjust Fire, out
Observer:	Grid 123 456, over
FDC:	Grid 123 456, out
Observer:	Troops in Trenches, VT in effect, over
FDC:	Troops in Trenches, VT in effect, out

Table 14. Example Adjust Fire Call for Fire.

FDC:	Message to Observer, T, 3 rounds, TGT # AA1004, over
Observer:	Message to Observer, T, 3 rounds, TGT # AA1004, break, direction 1860, over
FDC:	Direction 1860, out

Table 15. Example Adjust Fire Message to Observer.

FDC:	Shot, over
Observer:	Shot, out
Observer:	Right 50, Add 400, over
FDC:	Right 50, Add 400, out
FDC:	Shot, over
Observer:	Shot, out
Observer:	Left 30, Drop 200, over
FDC:	Left 30, Drop 200, out
FDC:	Shot, over
Observer:	Shot, out
Observer:	Add 100, over
FDC:	Add 100, out
FDC:	Shot, over
Observer:	Shot, out
Observer:	Drop 50, Fire for Effect, over
FDC:	Drop 50, Fire for Effect, out
FDC:	Shot, over
Observer:	Shot, out
FDC:	Rounds Complete, over
Observer:	Rounds Complete, out

Table 16. Example adjustments.

Observer:	End of Mission, troops neutralized, estimate 25 casualties, over
FDC:	End of Mission, troops neutralized, estimate 25 casualties, out

Table 17. Example Adjust Fire Battle Damage Assessment.

M. INTENDED USERS

As the name suggests, the Untrained Forward Observer (UFO) Translator is intended for “untrained” observers: Military personnel with no formal Call for Fire training. There are already devices available to help trained forward observers better perform their duties (discussed earlier in this chapter), but there are currently no systems that help untrained observers perform CFF.

As discussed in Chapter I, units sometimes need indirect fire but lack personnel proficient in conducting a proper Call for Fire. During these times, the unit or individual can use the UFO Translator to request indirect fire and engage enemy targets. Examples of non-trained personnel that may need to perform CFF include troops on patrol, reconnaissance missions, convoys that are attacked, and intelligence analysts observing enemy from an Unmanned Aircraft System (UAS) video feed.

N. USER REQUIREMENTS

The UFO Translator is meant to be so simple that any military member can use it without formal CFF training as well as without any training on the device itself. The user need only turn the device on, answer the questions presented, and the UFO Translator will “translate” the answers into a CFF that can be sent to a Fire Direction Center and processed into a Fire Mission.

Although the UFO Translator is designed for the untrained observer, the application is intended to be expandable and may eventually incorporate two additional modes—a Training Mode and a Planning Mode—for use by trained observers and observers that have no formal training but some experience in CFF and are more advanced than individuals with no training. The button to toggle these additional modes should be located on the side of the device underneath a rubber cover so that the untrained observer will not accidentally enter into one of these modes unintentionally when he or she is attempting to conduct an actual CFF mission. There will be more on Training Mode and Planning Mode in the next chapter.

O. CHAPTER SUMMARY

This chapter has given the reader a brief look at past and current training systems used to train forward observers and a glimpse at the Call for Fire process. By no means were the sections on Call for Fire all inclusive, but they contained the essential elements that will be encompassed by the UFO Translator, and they are important for understanding the design of the application discussed in Chapter III. Calling for Fire is not an easy skill to learn and even more difficult to retain without consistent practice. The UFO Translator will provide output for the user similar to the tables above by asking the user a series of simple questions and “translating” the answers into a proper Call for Fire format that the user can send to the FDC and have processed into a Fire Mission.

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III. DESIGN

A. SYSTEM DESCRIPTION

The UFO Translator is intended to be an application for use in operational environments to help untrained observers perform Call for Fire missions. It will ask the untrained observer a series of specific questions, and based on the answers, “translate” those answers into a CFF that the observer can send to a Fire Direction Center and have processed into a fire mission. The UFO Translator as a stand-alone device is meant to be portable and light enough to be carried by an infantryman on patrol; but as a software program, can be loaded onto other electronic devices and computers and used in a variety of capacities.

The objective is to make the UFO Translator so easy to use that any Soldier or Marine, regardless of rank, billet, or experience, can use the system with little to no training. To operate, the untrained observer need only turn the device on and begin answering questions.

B. CONCEPTUAL DESIGN

The UFO Translator, as an application, is intended to be usable on multiple platforms, from portable devices to desktop and laptop computers; but it should also be developed as a separate, stand-alone device. Since this application will be used by the warfighter in austere environments, the initial concept for a stand-alone device was an approximately tablet-sized (or smaller) ruggedized device. Figure 4 shows the initial design concept line drawing and Figure 5 shows a possible, more finalized design concept with labels.

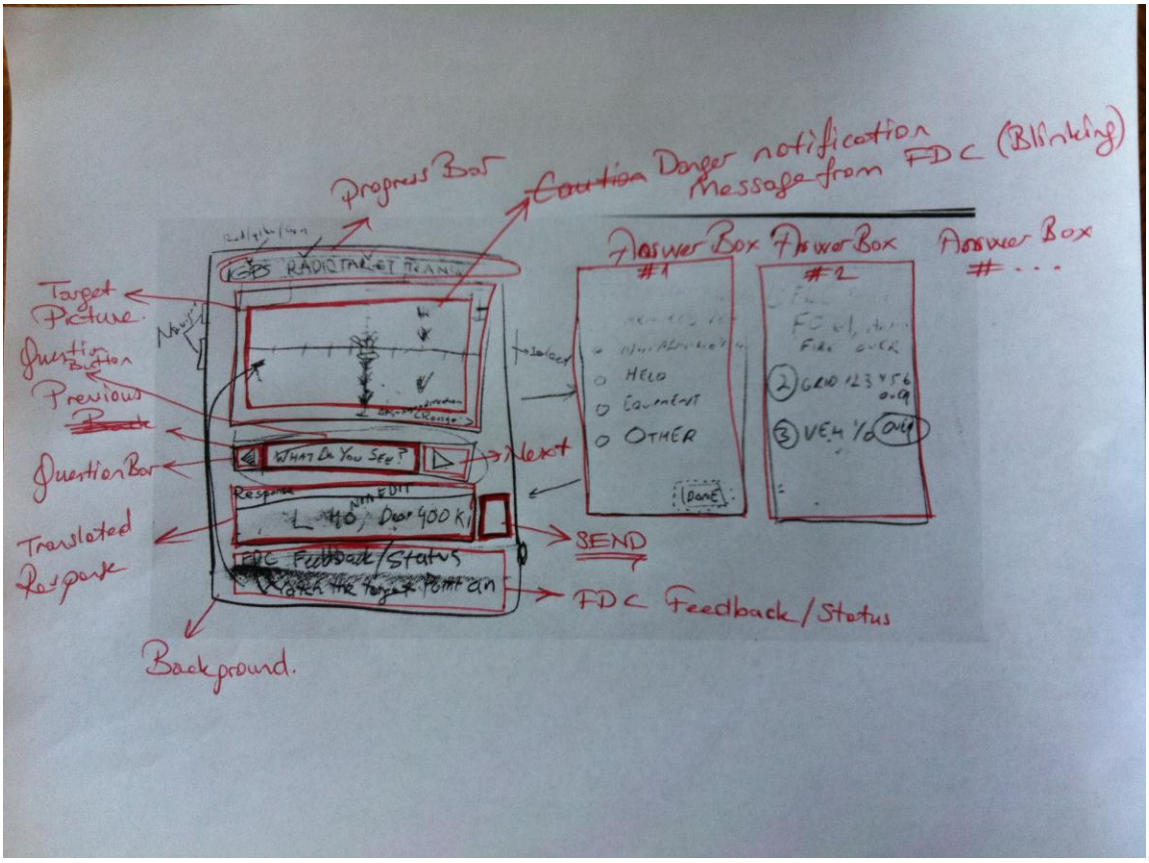

Figure 4. Initial UFO Translator conceptual design.

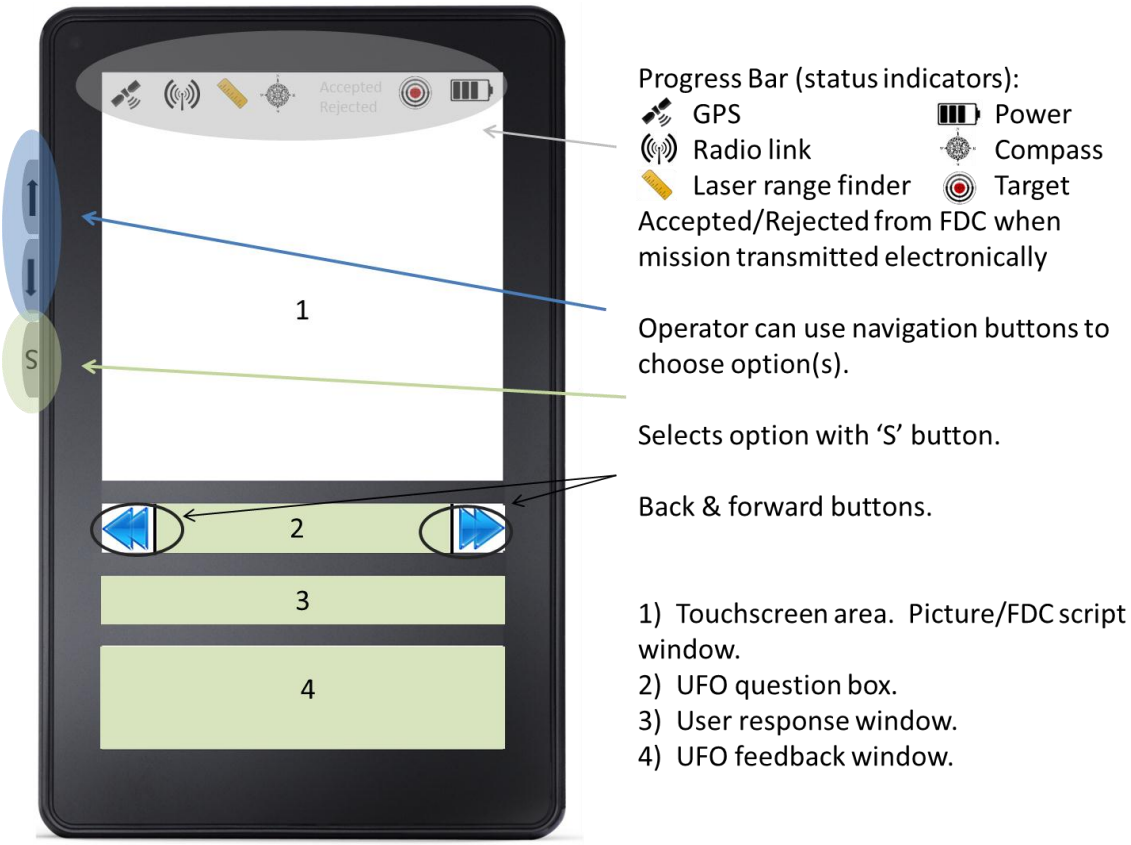

Figure 5. Possible UFO Translator stand-alone design.

Advantages to developing a stand-alone device include the potential to include embedded target location finding tools such as a range-finder, compass, GPS, and camera. These tools, once embedded, will make it easier for the user to gather the necessary target location information, but for the purposes of designing the initial prototype, we will assume these features are not immediately available. It will be much easier to design the system assuming the user is using primitive location finding tools (map, compass, binoculars) and then change the logic of the questions to accommodate the embedded tools at a later time, than to design it the other way around.

An actual working stand-alone prototype of the UFO Translator was not developed during this thesis; however, a JavaScript prototype was (as shown in Figure 5 above). The rest of this section describes the objects, attributes of objects, relationship between objects, actions on objects, actions on attributes,

and actions on relationships for all of the items in the JavaScript prototype shown in Figure 5.

1. **Objects**

    a. Background

        (1) Attributes

            a) Location

                - Spans the entire display.
                - All other objects are contained within the background.
                - The background is behind all other objects.

            b) Colors

                - High Contrast with the colors of all other objects.

        (2) Actions on Background

            a) None

        (3) Action on Background Attributes

            a) None; background attributes are static

    b. Progress Bar

        (1) Attributes

            a) Location

                - Located at the very top of the display.
                - Spans the entire width of the display.

            b) Content

- Static content containing the status of device functions and progress of the request.
- Contains the following icons: Radio Link, Laser Range Finder, Target, Request Accepted/Rejected, and Power.

c) Colors

- White background with dark and easy to understand icons.

(2) Actions on Progress Bar

a) Users moving over the progress bar initiate an information message explaining the success/failure in the Status Bar.

(3) Actions on Progress Bar Attributes

a) Any update related to the device functions are indicated by the corresponding icon’s blinking.

b) Authorization from the FDC is also indicated with a blinking icon.

- “ACCEPTED” from FDC is shown in green bold font.
- “REJECTED” from FDC is shown in red bold font.

c. Target Picture Box

(1) Attributes

a) Location

- Located just below the Progress Bar and above the Question Bar.

b) Content

- Target Picture Box includes the Camera Screen or a picture of the target depending on the progress of the request.
- Crosshair is in the middle of the Target Picture Box. For the last alignment, the crosshair is adjustable.

(2) Actions on Target Picture Box

a) Pressing on “Capture” takes the picture and captures the direction and distance (note: This feature will only be available when the device has embedded compass and laser range-finder).

b) Pressing on “Cancel” on captured picture initiates the camera on Target Picture Box again.

c) Crosshair can be dragged into its new position either by drag-and-drop or by clicking on the target.

(3) Actions on Target Picture Box Attributes

a) Target Picture Box appears when a question that requires the target picture is asked.

b) Target Picture Box's first appearance is with camera view and crosshair. Following appearances contain the captured image until it is cancelled for capturing the picture again.

d. Question Bar

(1) Attributes

a) Location

- Question Bar is located between Target Picture Box and Feedback Window.
- Question bar spans the entire width of the screen.

b) Content

- Question Bar has four buttons:
  - Previous: Navigates to the previous question.
  - Question: Displays the question.
  - Send Button: When every question is

answered, the “Send Button” appears between the “Next” and “Previous” button, replacing the Question area.

- Next: Navigates to the next question after submitting the present answer.

- Colors: Gray background with 3D buttons, and 3D Buttons are a gradient of blue color.

(2) Actions on Question Bar

a) Clicking on the “Next” button navigates to the next question.

b) Clicking on the “Next” button displays the Answer Box corresponding to the next question.

c) Clicking on the “Previous” button navigates to the previous question for editing.

d) Clicking on the “Send” button (when it appears) sends the request to the FDC; this initiates a blinking “SENDING” message in the Status/Feedback Bar. If the message was sent successfully, a “send successful” message will appear in the Question Bar.

(3) Actions on Question Bar Attributes

a) When the answer box is displayed, the Question Bar's "Next" button is locked (this is going to be shown by a dimming effect).

b) An acceptable response on the Answer Box unlocks the Question Bar.

c) Moving over the buttons creates a shining effect on the buttons.

d) Clicking on the button is demonstrated by a negative emboss effect.

e. Translated Response Bar

(1) Attributes

a) Location

- Between the Question Bar and FDC Feedback/Status Box.
- Spans the Entire Width of the Screen.

b) Content

- The translated response of the user is shown here to give the user awareness of what is happening behind the scenes.

c) Colors

- Gray background with black sans-serif text (not bold).

(2) Actions on Translated Response Bar

a) Translated Response box cannot be edited by the user.

(3) Actions on Translated Response Bar Attributes

a) The translated response that represents the chosen option in the Answer Box is immediately shown here.

f. Fire Direction Center (FDC) Feedback/Status Box

(1) Attributes

a) Location

- FDC Feedback/Status Box is located at the very bottom of the screen, below the Translated Response Bar.

b) Content

- Short messages, tips about current/next step.
- Feedback from FDC (activated after successful radio link and overrides all other messages).

c) Colors

- Gray background with black bold sans-serif text.

(2) Actions on FDC Feedback/Status Box

a) Translated Response Box cannot be edited by the user.

(3) Actions on FDC Feedback/Status Box Attributes

a) Feedback from FDC overrides the current messages displayed here.

b) Countdown for the fire is displayed here with blinking red bold font.

g. Answer Box

(1) Attributes

a) Location

- Answer Box takes the exact dimension and location of the Target Picture Box.

b) Content

- Depending on the question type, the Answer Box includes:
  - Options Box
  - Edit Box
  - Keyboard Box
  - Scroll Input Box for completely numeric inputs

c) Colors

- Answer Box has a white background with black text (font type is similar to system

terminal font types such as Courier New or Ubuntu Mono).

- Input Interfaces have White-Gray-Black Colors.

(2) Actions on Answer Box

a) User can edit the answer displayed in the answer box.

b) When the Answer Box is displayed, the tip about the question is shown in the FDC Feedback/Status Box.

(3) Actions on Answer Box Attributes

a) Answer Box is invisible until target picture is taken and alignment is performed.

b) Answer Box disappears after the “Send” button is clicked.

2. Relationships between Objects

a. Layout Location

(1) Each object’s location is static in order to decrease the adaption time.

(2) Some objects use the same location to maintain the attention of the user. The Answer Box replaces the Target Picture Box and the “Send” button appears in the middle of the “Previous” and “Next” buttons.

(3) An object appearing for the first time is mentioned in the status bar.

b. Content Changes Based on User Selections

(1) Clicking on the “Next” and “Previous” buttons updates the Translated Response Bar and the Answer Box/Target Picture Box.

(2) Users interfering with device functions (like connecting to the radio) see an indicator displayed in the Progress Bar and receive a message in the FDC Feedback and Status Box.

(3) Clicking on the Progress Bar icons initiates a message about the functionality and result of the request in the FDC Feedback and Status Box.

c. Visual Design

(1) High contrast between the colors of background and objects help the user distinguish the items.

(2) Look and feel is designed to help the user answer the following questions:

- Where am I?
- What am I supposed to do now?
- What is next?
- Where did I come from?
- How many more questions are there?

- What happened to my request? (Accepted/Rejected? And Why?)
- What does this icon mean?
- What functions on the device are working?
- Exactly when will the first round be fired?
- Does the FDC have any further instructions for me?

3. Actions on Relationships

The relationships between objects are described and designed at the program code level. They are kept static for the user to keep the interface simple.

C. LOGIC OF THE APPLICATION

This section outlines the logic of the questions that the UFO Translator will ask users in order to generate a Call for Fire mission. The graphics used in this section are based on the stand-alone device concept discussed in the previous section, and while the visual layout will be slightly different on a cell phone or laptop screen, the questions and logic involved remain the same, regardless of platform. Each question is shown in tree diagram form and as it would be seen on the device.

To use the UFO Translator, the user turns the device on and begins answering questions. Below is the first question of the logic tree and below that is the intro screen and first question as the user will see it on the device.

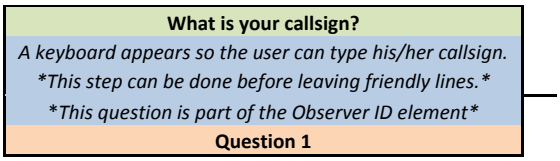

Figure 6. Question 1 (tree).

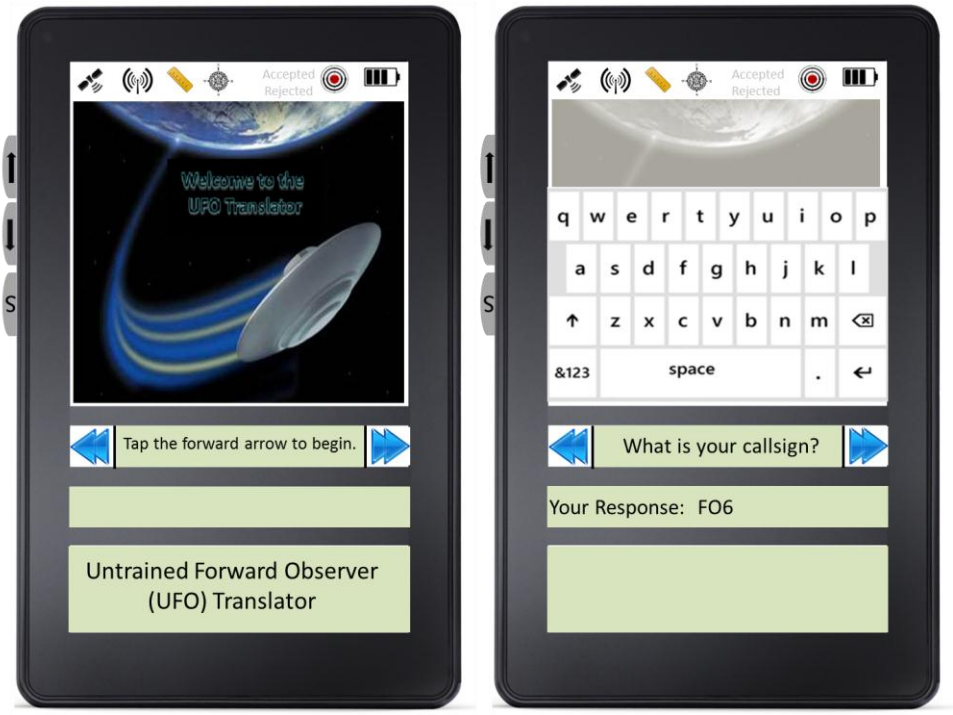

Figure 7. Intro screen and question 1 (device).

The intro screen is the first screen the user will see after turning on the device. To begin a Call for Fire, the user taps the forward arrow.

Question 1 asks, “What is your callsign?” This question is part of the Observer Identification element of the Call for Fire. The user enters his or her callsign using the keypad on the screen. This step can and should be done before leaving friendly lines. In the above figure, the user has entered “FO6” as his or her callsign. The user taps the forward arrow to navigate to the next screen.

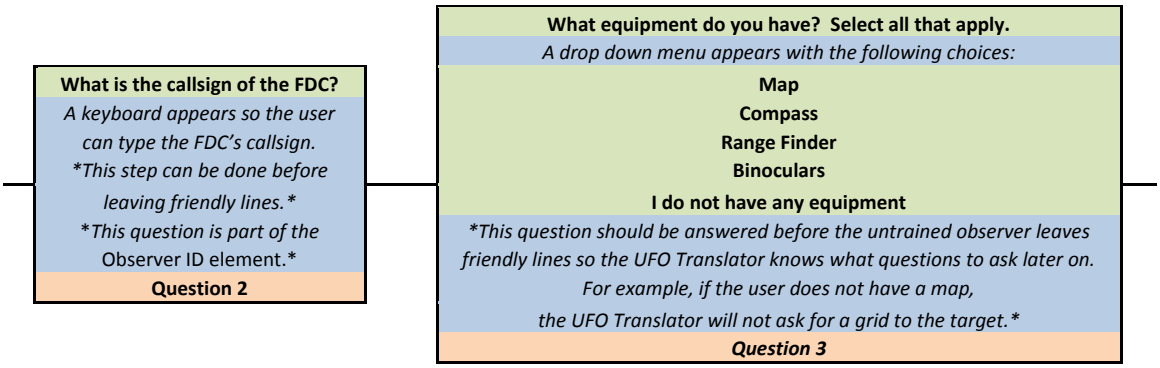

Figure 8. Questions 2 and 3 (tree).

Figure 9. Questions 2 and 3 (device).

Question 2 asks, "What is the FDC's callsign?" This question is also part of the Observer Identification element of the Call for Fire. The user enters the FDC's callsign (which can be found in the CEOI) using the keypad on the screen. This step should be done before leaving friendly lines, but can be changed at any time. In the above figure, the user has entered "FDC" as the FDC's callsign. The user taps the forward arrow to navigate to the next screen.

Question 3 asks, “What equipment do you have? Select all that apply.” The user taps on the radio buttons from the drop down menu to select his or her equipment. This question should be answered before leaving friendly lines so the UFO Translator knows what questions to ask later on. If users lose or gain equipment, they can navigate back to this screen and change their answer(s). The response window confirms the selection(s) and the user taps the forward arrow to navigate to the next screen.

For the purpose of brevity, insignificant branches of the logic tree will not be shown. Question 3 above generates eight different branches depending on what equipment the observer is carrying: (1) Map only; (2) compass only; (3) range finder only; (4) map and compass; (5) map and range finder; (6) compass and range finder; (7) map, compass, and range finder; and (8) the user has no equipment (note: it does not matter until later in the logic tree whether the user has binoculars). See Appendices B through I for the logic tree in its entirety. Some of the questions will differ depending on the equipment the observer is carrying. For example, if the observer does not have a map, the UFO Translator will not ask the user for a grid to the target; it will ask for direction and distance instead to generate a Polar mission. Differences in questions will be noted throughout this section.

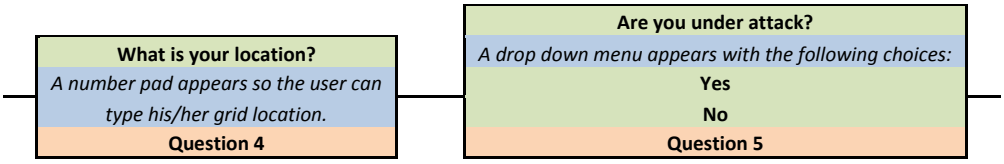

Figure 10. Questions 4 and 5 (tree).

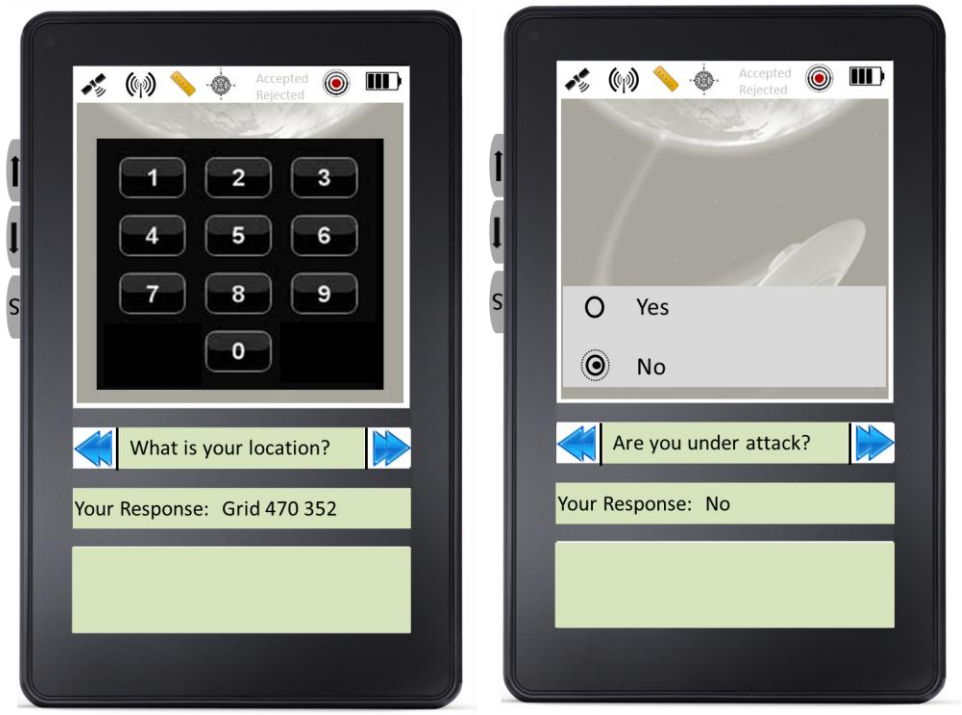

Figure 11. Questions 4 and 5 (device).

Question 4 asks, “What is your location?” The FDC does not need to know the observer’s location when doing a Grid mission. However, this question will always be asked as a safety measure to ensure the user is not asking for rounds on his or her own location. Soldiers and Marines that leave friendly lines are required to report their position at pre-designated intervals, so it is assumed the user will have a means of determining his or her location. The operator taps on the number pad to enter his or her grid location. In figure 11, the user has entered 470 352 as his/her grid. The user taps the forward arrow to navigate to the next screen.

Question 5 asks, “Are you under attack?” The purpose for this question is to determine whether an Immediate Suppression mission is needed. The user selects either “yes” or “no” by tapping on one of the choices from the drop down menu. If “yes” is chosen, the UFO Translator asks for the target location and generates an Immediate Suppression mission to engage the target as quickly as

possible. If “no” is chosen, as in the figure above, different and more detailed questions are asked. The user taps the forward arrow to continue.

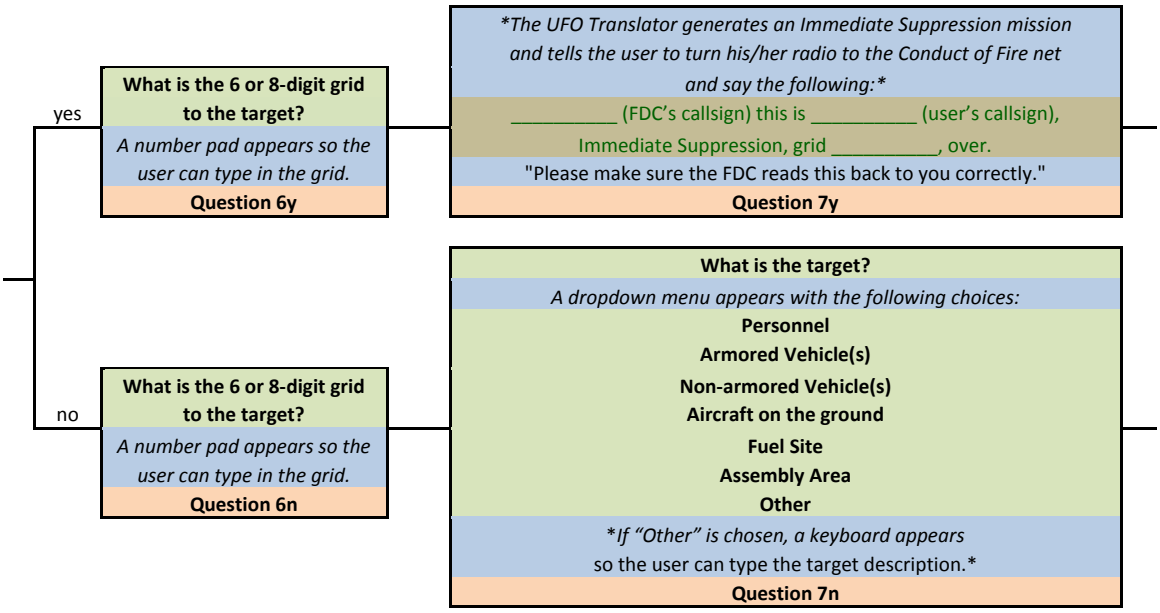

Figure 12. Questions 6 and 7 (tree).

Figure 13. Questions 6 and 7 (device).

Question 6 asks, “What is the grid of the target?” This question is part of the Target Location element of the Call for Fire. The user indicated earlier that they have a map, so the UFO Translator asks for the grid to the target. If the user prefers to do a Polar mission rather than a Grid mission, he or she can leave this answer blank and tap the forward arrow, prompting the UFO Translator to ask for a direction and distance to generate a mission using the Polar method of target location. In the figure above, the user has entered “478 362” on the number pad as the grid to the target.

Question 7 asks, “What is the target?” This question is part of the Target Description element of the Call for Fire. The user chooses one option from the drop down menu. If “other” is chosen, a keyboard appears so the user can type the target description. In the figure above, the user has chosen “armored vehicles.” The user taps the forward arrow to continue.

Question 6 is the same for branches “a” (map only), “d” (map & compass), “e” (map & range finder), and “g” (map, compass, & range finder), because the observer has a map in each of these scenarios. Question 6 for branches “b” (compass only) and “f” (compass & range finder), where the observer has a compass but no map, the UFO Translator asks, “Are you using degrees or mils on your compass” and allows the user to pick “degrees” or “mils” from the drop down menu. This question is followed by, “What is the direction to the target?” When the observer does not have a map or a compass, as in branches “c” (range finder only) and “h” (no equipment), the UFO Translator asks, “What is the direction to the target?” and allows the user to pick a cardinal direction from the drop down menu. The UFO Translator converts the cardinal direction into mils (grid).

Non-map users will then be asked for a range to the target. If the user indicated that they have a laser-range finder, they will be asked to use it to get a range to the target in meters. If no laser-range finder is available, the UFO Translator will ask the user to estimate the number of football fields there are between the user and the target; the UFO Translator then converts this number into meters.

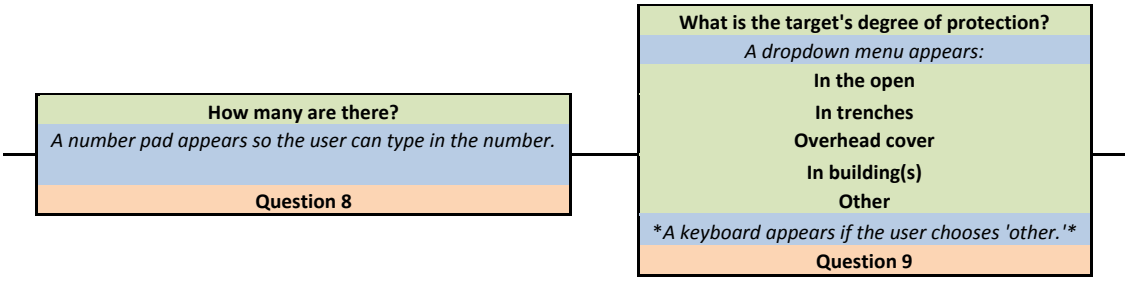

Figure 14. Questions 8 and 9 (tree).

Figure 15. Questions 8 and 9 (device).

Question 8 asks, “How many are there?” This question is also part of the Target Description element of the Call for Fire. The user types the number using the number pad. In the figure above, the user has typed “2” as the number of armored vehicles. The user taps the forward arrow to continue.

Question 9 asks, “What is target degree of protection?” This question is part of the Target Description element of the Call for Fire. The user chooses one option from the drop down menu. If “other” is chosen, a keypad appears so the

user can type the target's degree of protection. In the figure above, the user has chosen, "In the open." The user taps the forward arrow to continue.

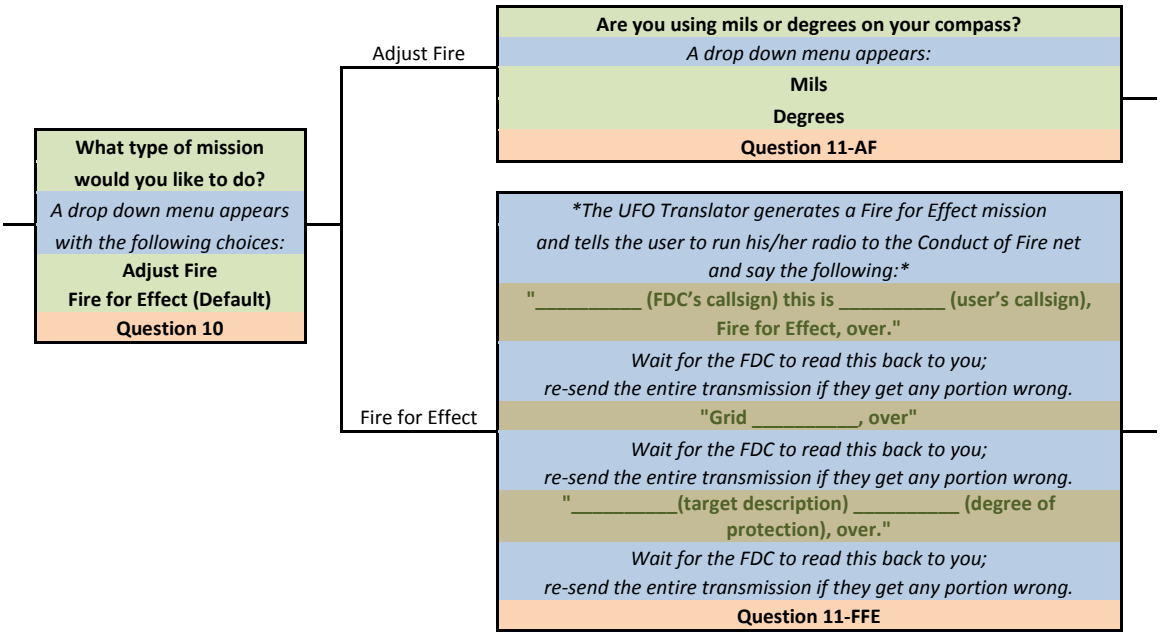

Figure 16. Questions 10 and 11 (tree).

Figure 17. Questions 10 and 11 (device).

Question 10 asks, “What is the mission type?” This question is part of the Warning Order element of the Call for Fire. The user chooses either “Adjust Fire” or “Fire for Effect” from the drop down menu. Though there are more missions than these two that can be attempted by a more advanced observer, the UFO Translator will only offer these two choices to keep it simple and because these missions are sufficient to handle almost any target of opportunity. If the untrained observer has no idea what mission to choose, the UFO Translator recommends Fire for Effect in the Feedback Box. In the figure above, the user has selected “Adjust Fire.” The user taps the forward arrow to continue.

Question 11 asks, “Are you using Mils or Degrees on your compass?” The user may not know what mils are, so the UFO Translator explains in the Feedback Box that mils are the black numbers on the outer ring of the compass and degrees are the red numbers on the inner ring. This question lets the UFO Translator know how many numbers to expect when it asks for the direction on the next screen: Four numbers for mils or three numbers for degrees. In the figure above, the user selects “mils.” The user taps the forward arrow to continue.

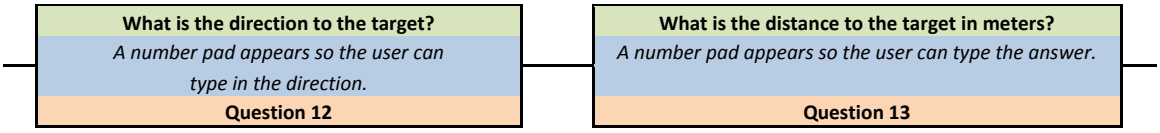

Figure 18. Questions 12 and 13 (tree).

Figure 19. Questions 12 and 13 (device).

Question 12 asks, “What is the direction to the target?” This question is generally not part of the Target Location when doing a Grid mission (it is when doing a Polar mission), but because the user selected “Adjust Fire” instead of “Fire for Effect,” the UFO Translator needs to know the direction to the target to help the observer make deviation corrections later on. Without the direction to the target, the UFO Translator would not have a reference for “left” or “right” corrections made by the observer. In the figure above, the user selects “1630” on the number pad as the direction to the target (in mils). The user taps the forward arrow to continue.

Question 13 asks, “What is the distance to the target (in meters)?” This question is generally not part of the Target Location when doing a Grid mission (it is when doing a Polar mission); but because the user selected “Adjust Fire” instead of “Fire for Effect,” the UFO Translator will need to know the distance to the target to determine the OT Factor and help the observer make deviation corrections later on. This question is asked because the user indicated he or she

has a laser range finder. If the user did not have a laser range finder, the UFO Translator would ask the user to estimate the number of football fields between the observer and the target, then that number would be converted into meters. The user types the range to the target using the number pad. In the figure above, the user has entered “2100” on the number pad as the range to the target. The user taps the forward arrow to continue.

The UFO Translator generates an Adjust Fire mission and tells the user to turn his/her radio to the Conduct of Fire net and say the following.
"_____ (FDC's callsign) this is _____ (user's callsign), Adjust Fire, over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"Grid _____, over"
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"_____(target description) _____ (degree of protection), _____ (method of engagement - if any), over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
Question 14

Figure 20. Question 14 (tree).

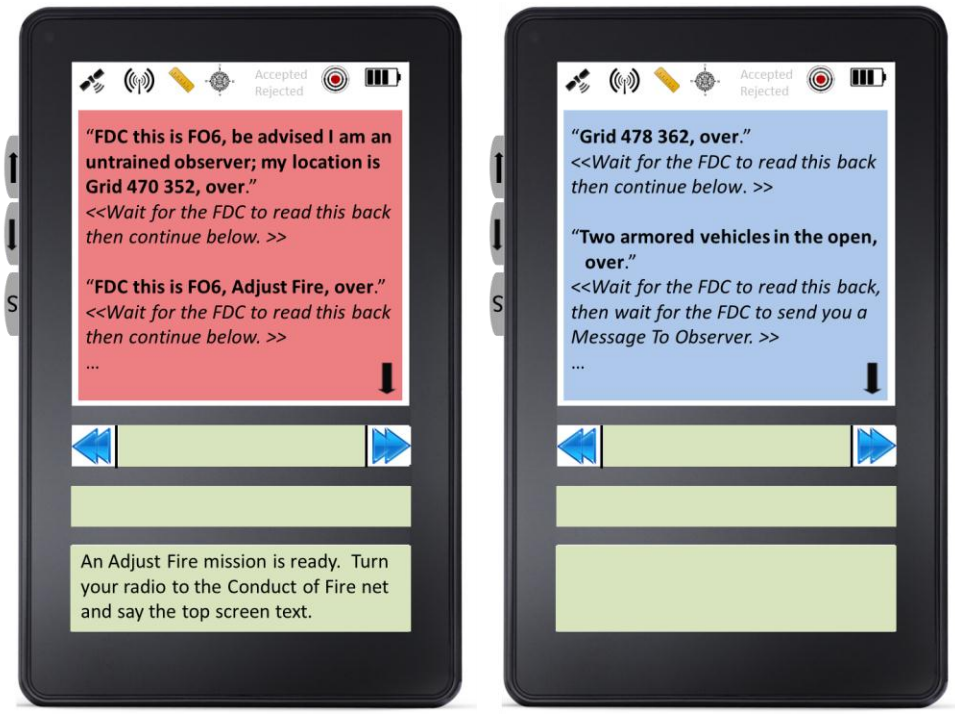

Figure 21. Questions 14a and 14b (device).

Questions 14a and 14b (not really questions) tell the observer exactly what to say to the FDC on the radio. In the feedback box at the bottom of 14a, it

tells the user to turn his/her radio to the Conduct of Fire net and say the top screen text. Note that the user notifies the FDC that he or she is an untrained observer in the first transmission; this is an added safety precaution. The user taps the forward arrow to navigate to the next screen and continues the Call for Fire. After transmitting everything on 14a and 14b to the FDC, the user taps the forward arrow and awaits the Message to Observer.

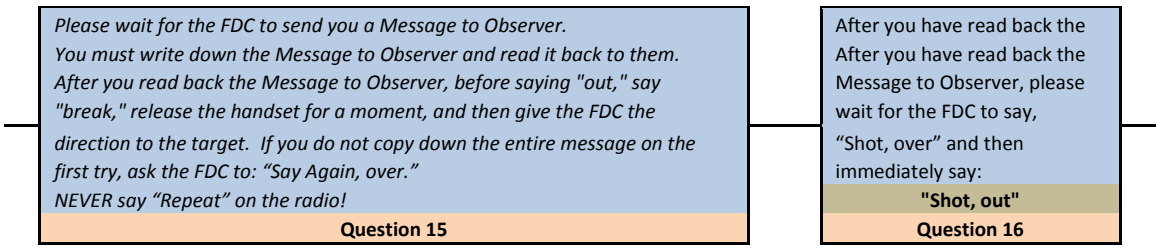

Figure 22. Questions 15 and 16 (tree).

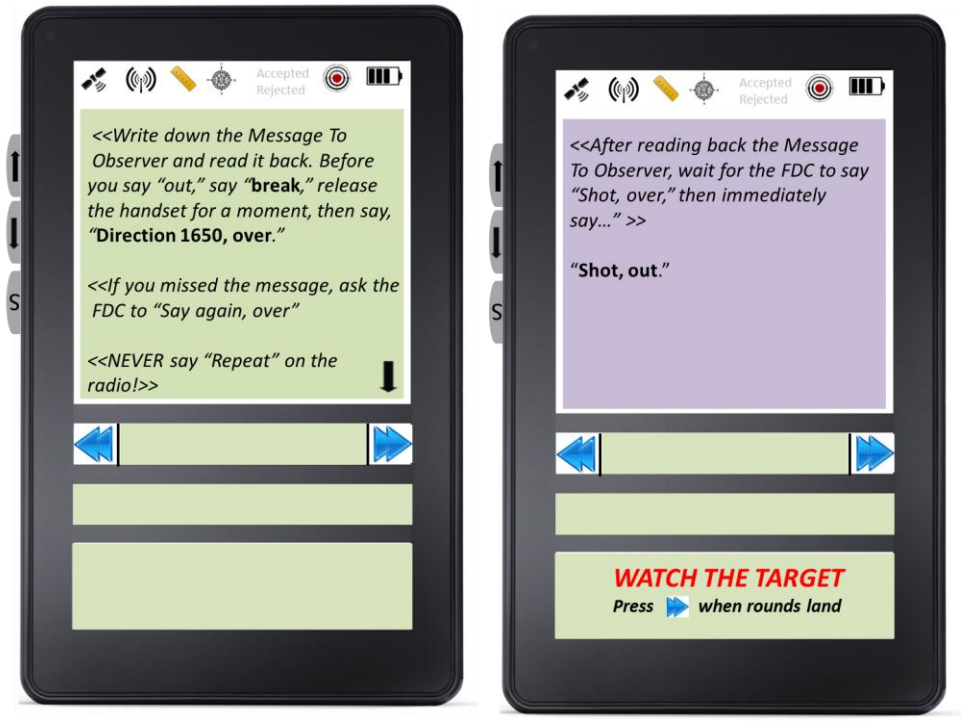

Figure 23. Questions 15 and 16 (device).

Question 15 (not really a question) advises the observer to write down the Message to Observer when the FDC sends it in order to read it back verbatim. However, since the observer is doing an Adjust Fire mission, the FDC needs to

know the direction to the target, and immediately after reading back the Message to Observer is the best time to send it. The observer should read back the Message to Observer and then instead of saying “out,” say “break,” release the button on the handset for a moment, and then give the direction, which in the figure above, is “1630.” The user taps the forward arrow to navigate to the next screen.

Question 16 (not really a question) advises the observer to watch the target and await the first round of the mission. Once the FDC announces “shot, over,” the observer should immediately respond with, “shot, out.” The user taps the forward arrow to navigate to the next screen.

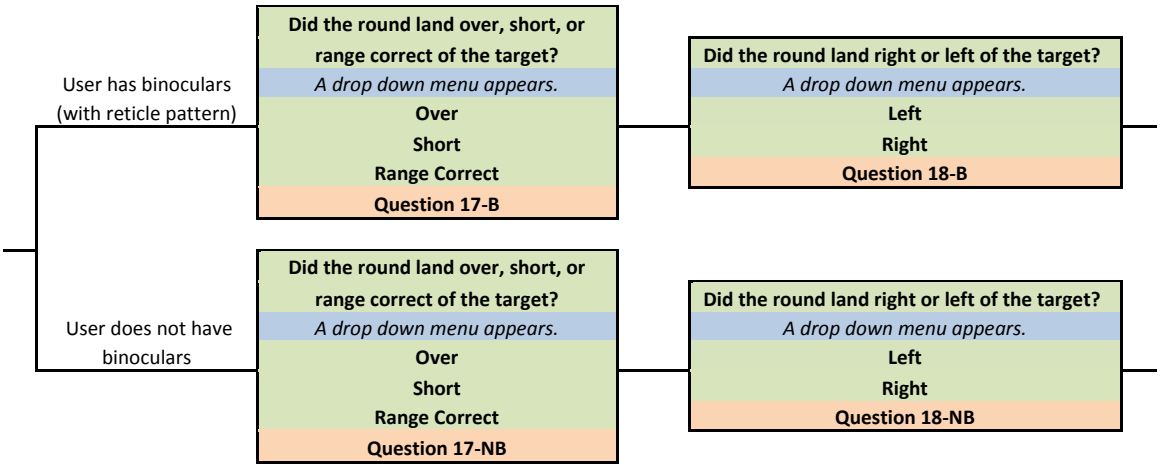

Figure 24. Questions 17 and 18 (tree).

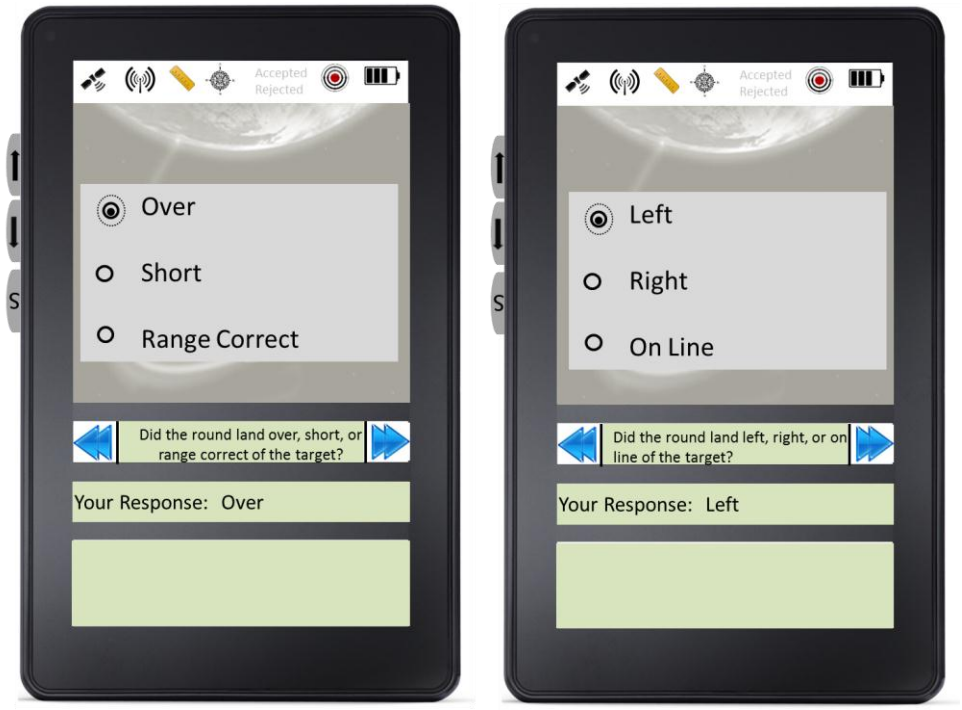

Figure 25. Questions 17 and 18 (device).

Question 17 asks, “Did the round land over, short, or range correct of the target?” This question is establishing the range portion or the spotting. The user selects an option from the drop down menu. In the figure above, the user has selected “over.” The user taps the forward arrow to continue.

Question 18 asks, “Did the round land left, right, or on line of the target?” This question is establishing the deviation portion of the spotting. Once the UFO Translator has both the range and deviation spottings, it will convert it into a correction that the observer can send to the FDC. The user selects an option from the drop down menu. In the figure above, the user has selected “Left.” The user taps the forward arrow to continue.

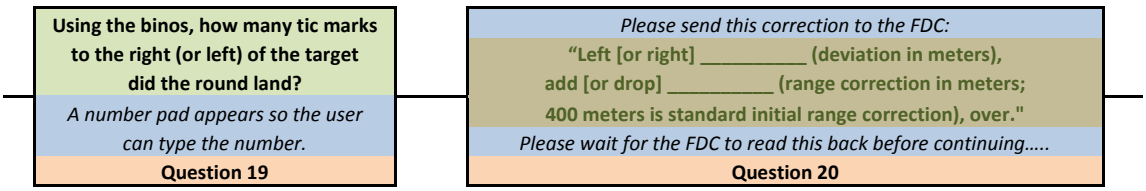

Figure 26. Questions 19 and 20 (tree).

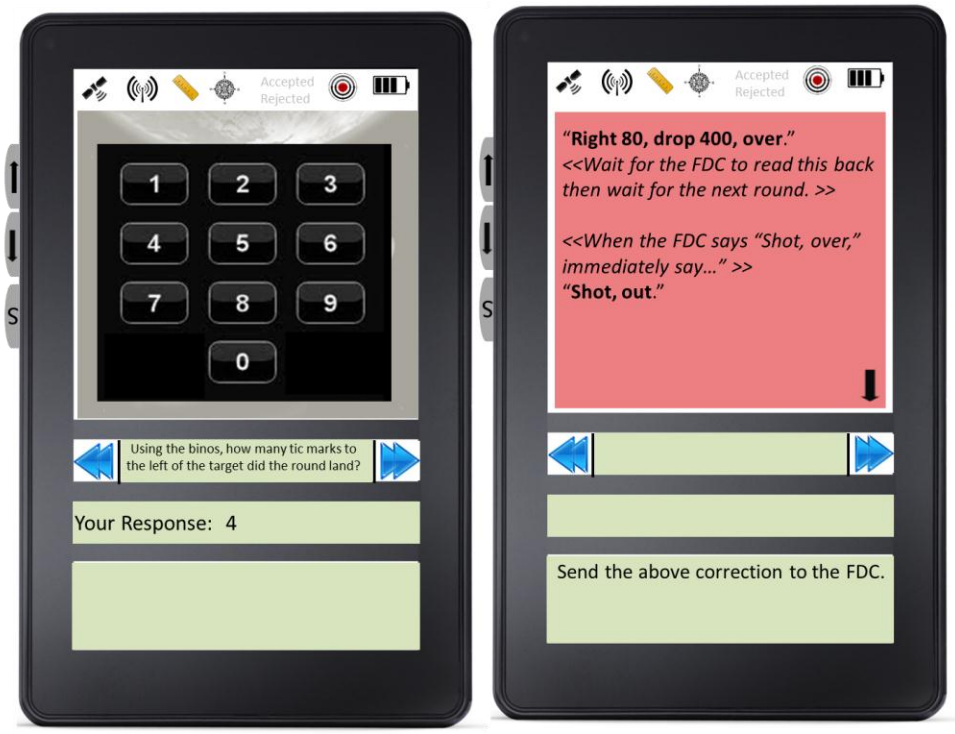

Figure 27. Questions 19 and 20 (device).

Question 19 asks, "Using the binos, how many tic marks to the left did the round land?" Each tic mark in the binoculars is equal to ten mils, and the observer entered "4" tic marks on the number pad, so the UFO Translator knows that the round landed 40 mils to the left of the target. It was established earlier that the range to the target is 2100 meters, so the UFO Translator calculates the Observer to Target Factor (OT Factor) by dividing the range by 1000 and expressing the result to the nearest whole number. 2100 / 1000 = 2.1, which expresses to 2, so the OT Factor is 2. The UFO Translator takes the OT Factor and multiplies it by the deviation spotting (40) to generate a deviation correction of "right 80." The user taps the forward arrow to continue.

Question 20 (not really a question) tells the observer what to say to the FDC to send the first correction. In the figure above, the correction is "Right 80, drop 400, over." It was explained in the previous paragraph how the deviation correction of "Right 80" was obtained, and the UFO Translator automatically starts with a range correction of add/drop 400 until a bracket is achieved (one

round over and one round short of the target). Since the user entered “over” as the range spotting, the UFO Translator told the user to “drop” 400. If a bracket is achieved on the next round, all subsequent range corrections will be cut in half until the 100-meter bracket is broken (add/drop 50). If a bracket is not achieved after dropping 400, then the UFO Translator will continue to have the user drop 400 until a bracket is achieved. After the user ensures the FDC correctly reads back the correction, he/she waits to hear “shot, over” and then immediately responds with “shot, out.” The user taps the forward arrow to continue.

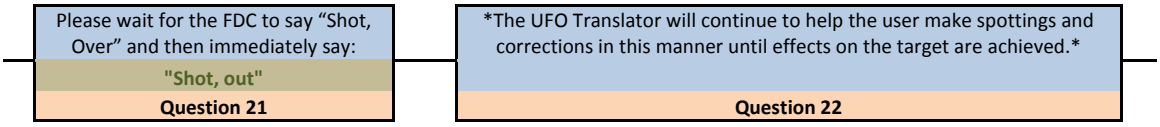

Figure 28. Questions 21 and 22 (tree).

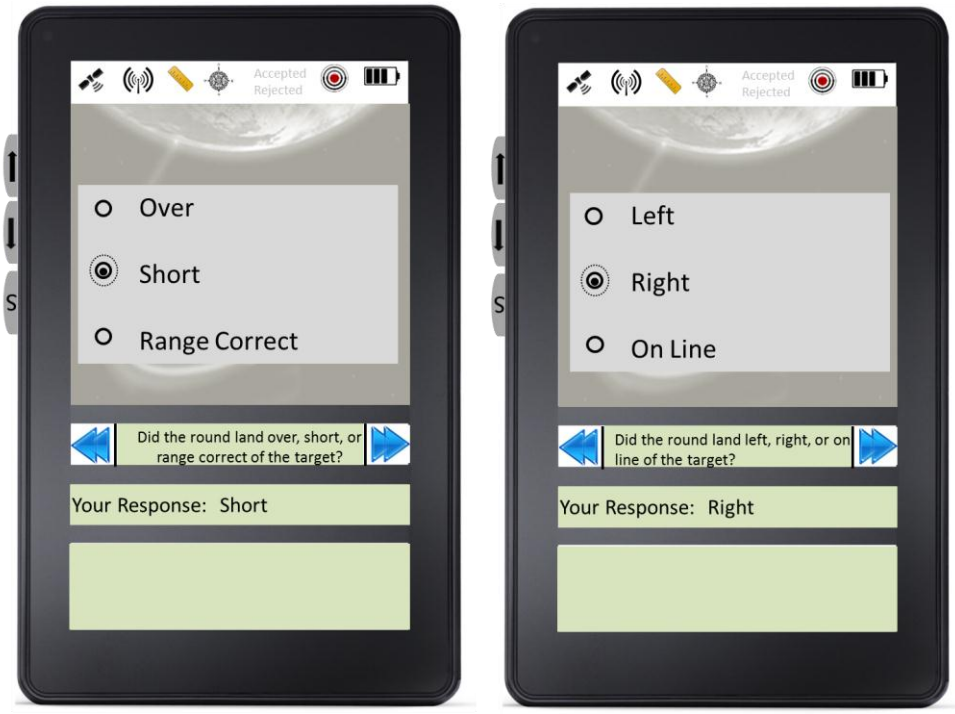

Figure 29. Questions 21 and 22 (device).

Question 21 is the same as question 17: It asks, “Did the round land over, short, or range correct of the target?” Range and deviation spotting questions will continue to be asked until the user sends “Fire for Effect.” The user selects an

option from the drop down menu. In the figure above, the user has selected “Short.” Since the first range spotting was “over” and the second range spotting was “short,” the UFO Translator knows that a bracket has been established and will ensure all range corrections are cut in half for the remainder of the mission. The user taps the forward arrow to continue.

Question 22 is the same as question 18: It asks, “Did the round land left, right, or on line of the target?” Note that a bracket does not need to be achieved with deviation; only with range. The user selects an option from the drop down menu. In the figure above, the user has selected “Right.” The user taps the forward arrow to continue.

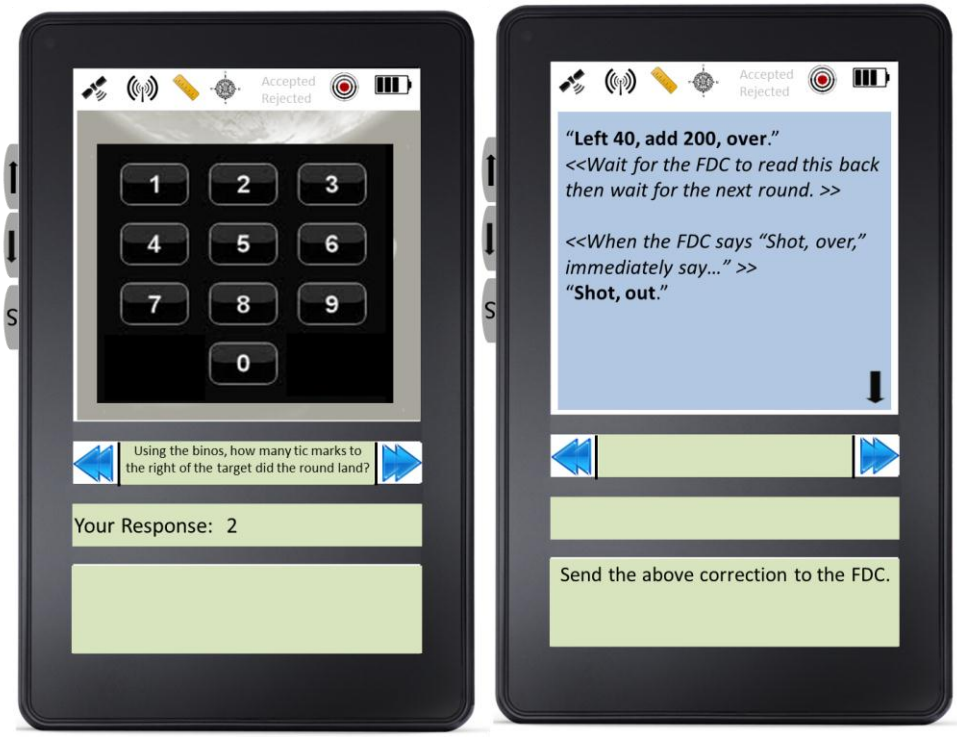

Figure 30. Questions 23 and 24 (device).

Question 23 is similar to question 19: It asks, “Using the binos, how many tic marks to the right did the round land?” The user enters “2” on the number pad and the UFO Translator performs its calculations: Two tic marks equals 20 mils, multiplied by the OT Factor 2, results in a correction of “Left 40.” The user taps the forward arrow to continue.

Question 24 (not really a question) tells the observer what to say to the FDC to send the second correction. In the figure above, the correction is “Left 40, add 200, over.” Since the first round landed over the target and the second round landed short, a bracket was achieved and the initial range correction was cut in half from “drop 400” to “add 200.” After the user ensures the FDC correctly reads back the correction, he/she waits to hear “shot, over” and then immediately responds with “shot, out.” The user taps the forward arrow to continue.

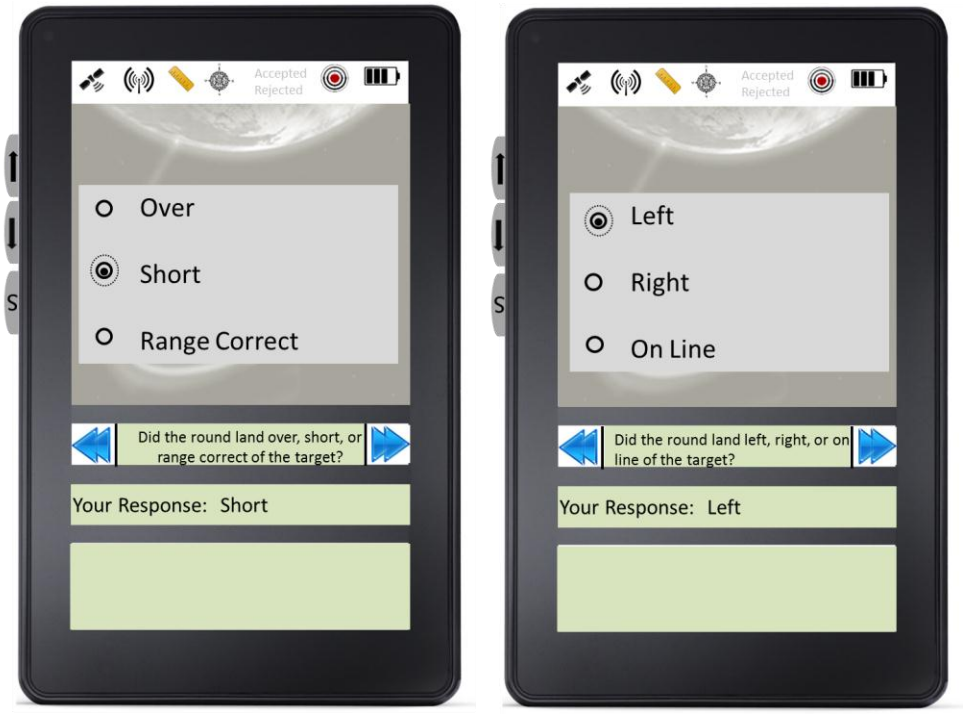

Figure 31. Questions 25 and 26 (device).

Question 25 asks, “Did the round land over, short, or range correct of the target?” The user selects an option from the drop down menu. In the figure above, the user has selected “Short.” Once an initial bracket is achieved, the user can continue to cut the range corrections in half, even if there are two or more “short” or “over” spottings in a row. The user taps the forward arrow to continue.

Question 26 asks, “Did the round land left, right, or on line of the target?” The user selects an option from the drop down menu. In the figure above, the user has selected “Left.” The user taps the forward arrow to continue.

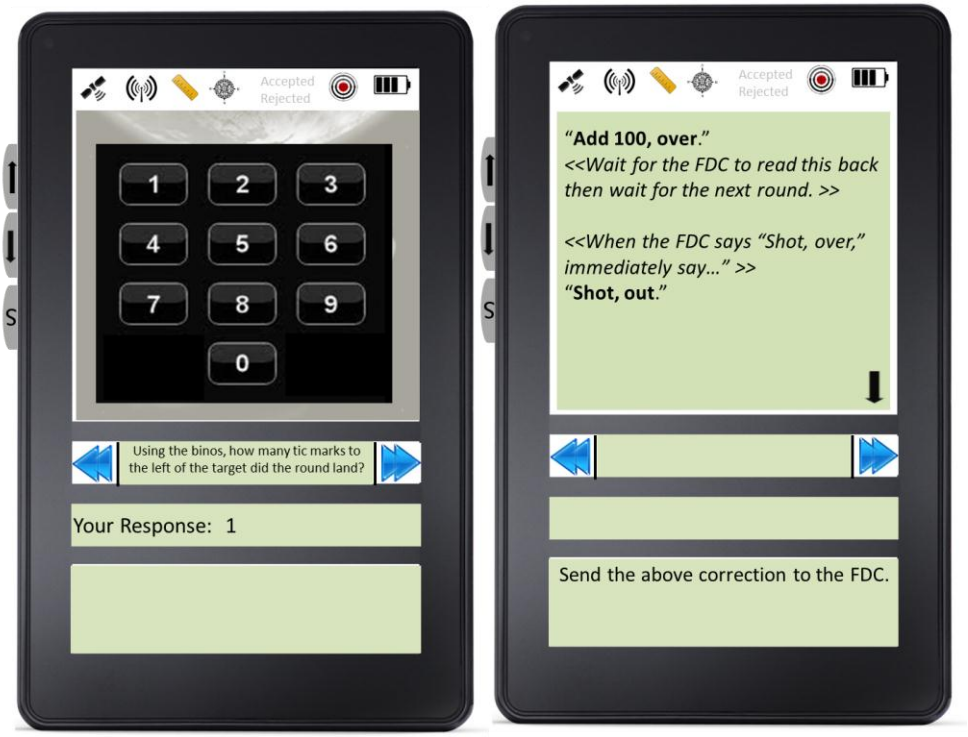

Figure 32. Questions 27 and 28 (device).

Question 27 asks, “Using the binos, how many tic marks to the left did the round land?” The user enters “1” on the number pad and the UFO Translator performs its calculations: One tic mark equals 10 mils, multiplied by the OT Factor 2, equals 20 meters. Since deviation corrections of less than 30 meters are not sent (because artillery and mortars are area fire weapons), no deviation correction is necessary. The user taps the forward arrow to continue.

Question 28 (not really a question) tells the observer what to say to the FDC to send the third correction. In the figure above, the correction is “Add 100, over.” After the user ensures the FDC correctly reads back the correction, he/she waits to hear “shot, over” and then immediately responds with “shot, out.” The user taps the forward arrow to continue.

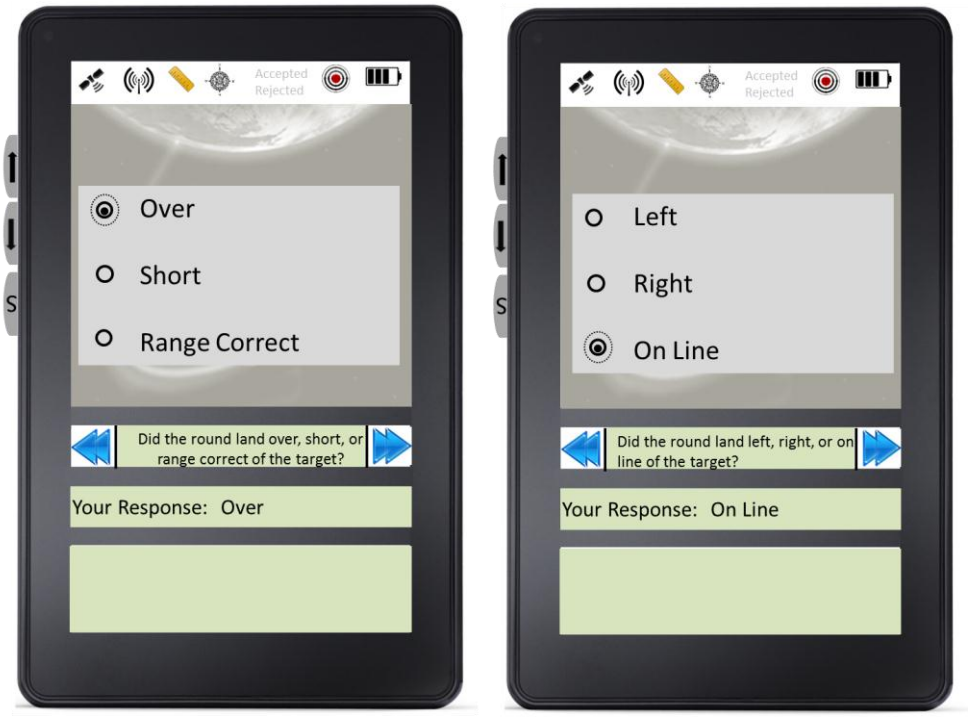

Figure 33. Questions 29 and 30 (device).

Question 29 asks, “Did the round land over, short, or range correct of the target?” The user selects an option from the drop down menu. In the figure above, the user has selected “Over.” The user taps the forward arrow to continue.

Question 26 asks, “Did the round land left, right, or on line of the target?” The user selects an option from the drop down menu. In the figure above, the user has selected “On Line.” The user taps the forward arrow to continue.

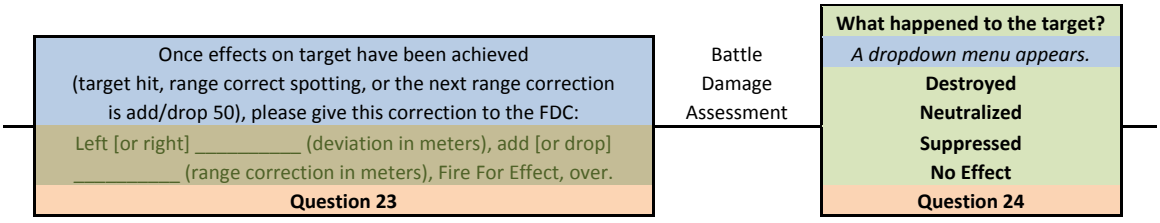

Figure 34. Questions 23 and 24 (tree).

Please note that due to the additional corrections needed to achieve effects on target, the tree questions and the device questions no longer match numerically.

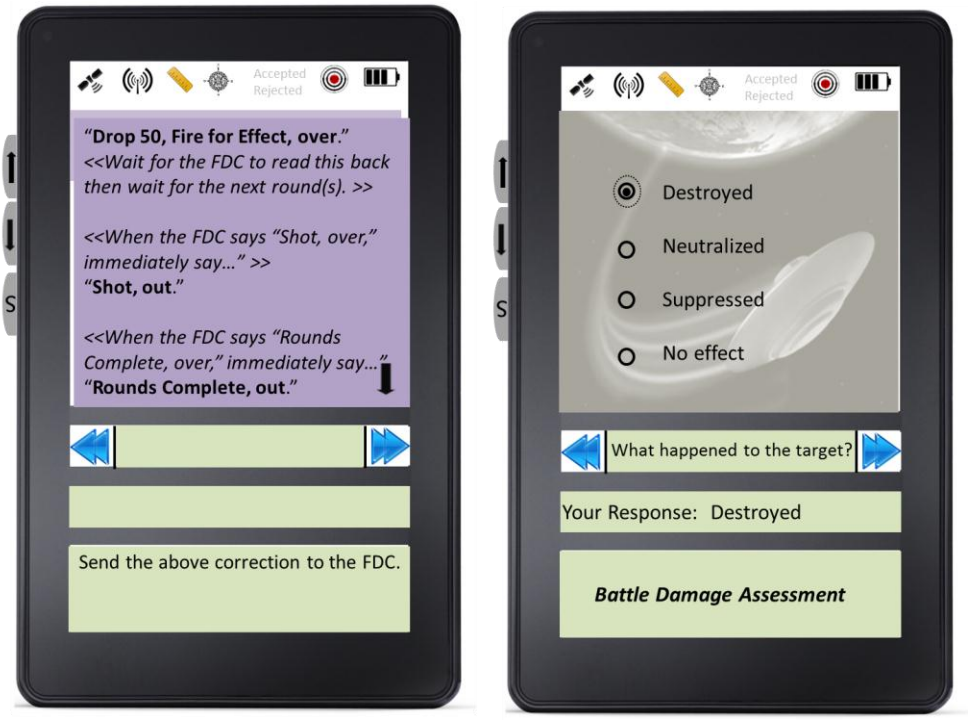

Figure 35. Questions 31 and 32 (device).

Question 31 (not really a question) tells the observer what to say to the FDC to send the final correction. In the figure above, the correction is "Drop 50, Fire for Effect, over." After the user ensures the FDC correctly reads back the transmission, he/she waits to hear "shot, over" and then immediately responds with "shot, out;" and after the FDC transmits "rounds complete, over," the observer immediately responds with, "rounds complete, out." The user taps the forward arrow to continue.

Question 32 asks, "What happened to the target?" and gives the user a dropdown menu with several options to choose from. This question is part of the Battle Damage Assessment. In the figure above, the user has selected "destroyed." The user taps the forward arrow to continue.

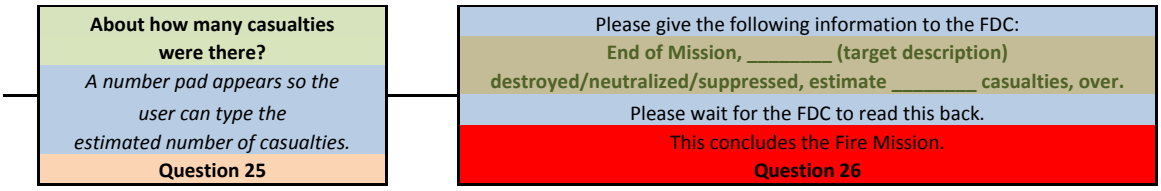

Figure 36. Questions 25 and 26 (tree).

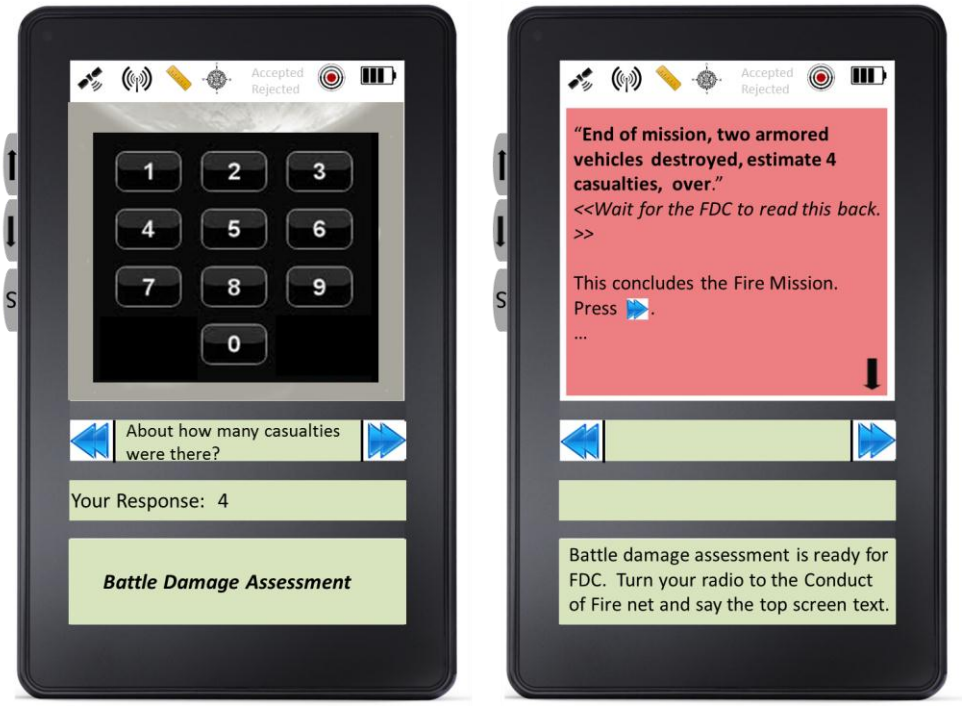

Figure 37. Questions 33 and 34 (device).

Question 33 asks, "About how many casualties were there?" Very rarely will an observer know the exact number of casualties, so estimating is acceptable. The user enters the estimated number of casualties on the number pad. In the figure above, the user has entered "4." The user taps the forward arrow to continue.

Question 34 (not really a question) tells the observer what to say to the FDC to send the Battle Damage Assessment (also called the End of Mission Statement). In the figure above, the End of Mission Statement reads, "End of Mission, two tanks destroyed, estimate four casualties, over." The Adjust Fire mission is ended once the FDC reads this back. The user taps the forward arrow to return to the introduction (home) screen.

D. SYSTEM MODES

It may be beneficial in future iterations of the UFO Translator to include a Training Mode and Planning Mode to complement the existing Operational Mode outlined above. With an Operational Mode only, there is a chance the UFO Translator would rarely get used and may even be forgotten in the heat of a battle or engagement; a Training Mode would engender greater usage, greater familiarization with the device, and improve proficiency with CFF. A Planning Mode would be ideal for more advanced observers, including Reconnaissance Marines and Army Rangers, to create target lists and pre-planned targets that do not need to be engaged immediately.

1. Operational Mode

In Operational Mode, the UFO Translator is designed to ask the untrained observer a series of questions and then “translate” the answers into a proper Call for Fire format that the observer can send to the Fire Direction Center to have processed into a fire mission. The three main functions of the UFO Translator in Operational Mode are to (1) generate the initial Call for Fire, (2) help the observer adjust rounds onto target, and (3) help generate an End of Mission Statement. As discussed in the previous section, some of the questions will be yes/no, some will have drop down menus with options for the observer to choose from, and others will be fill in the blank.

Once the UFO Translator has all the information it needs to generate the CFF, it will ask the untrained observer to pick up the radio handset and call the Fire Direction Center, telling him/her what to say to the FDC. In future iterations, the UFO Translator should be capable of connecting to a radio, either through a cabled or wireless interface, so the user can send the Call for Fire digitally, reducing potential errors in verbal communication. After the first round or rounds impact, the UFO Translator helps untrained observers adjust the rounds onto target by asking questions about the spottings of rounds and converts those answers into corrections.

In the example Adjust Fire mission from the previous section, the notional observer had binoculars to help with deviation corrections. If an observer does

not have binoculars, the UFO Translator can still help with spottings and corrections using the Finger Method discussed in Chapter II. And finally, the UFO Translator will ask questions to generate the End of Mission Statement. Although “refinement” and “record as target” are elements of the End of Mission Statement, because they are optional, the UFO Translator will not include them as part of the BDA. Refining and recording are generally used with the intention of re-firing a target or using it to conduct a Shift from a Known Point mission, which is beyond the scope of an untrained observer.

2. Training Mode

Unlike Operational Mode, which will only get used when actual fire missions are needed to engage enemy targets, Training Mode can be used at any time to practice and become more proficient at Calling for Fire. Since Training Mode is embedded in the system with Operational Mode, with frequent use, observers will become more familiar with the UFO Translator and more confident in using it when an actual fire mission is needed.

Training Mode should incorporate several features to help untrained observers become more proficient at Call for Fire such as lesson plans. The UFO Translator should have many lesson plans to help users understand and get better at generating the six elements of the CFF that make up the three transmissions. The lesson plans should also cover the various types of missions that are available, such as Suppression of Enemy Air Defense (SEAD), Quick Smoke missions, Illumination missions, Immediate Suppression missions, Fire for Effect missions, and Adjust Fire missions. There should be instruction on adjusting rounds onto target using spottings and corrections, as well as information on map reading and terrain analysis to help improve the accuracy of estimating target location.

In addition to the lessons, the UFO Translator could provide many examples of Calls for Fire to help the user see and understand how proper terminology is used and how the information exchange between the observer

and FDC flows during an actual fire mission. There might also be games that the user can play to improve CFF proficiency with easy, intermediate, and difficult levels depending on the user's experience. With Training Mode, users would become more familiar with the UFO Translator, more proficient at Calling for Fire, and a better asset to their unit.

3. Planning Mode

Planning Mode is intended for more advanced observers, as well as reconnaissance personnel, and personnel involved in offensive and defensive planning. In Planning Mode, users could fill out all of the data on pre-planned targets in order to have missions in the queue ready to be fired at a moment's notice. Users could create Fire Plans, Target List Worksheets, Final Protective Fires (FPF), and other Forward Observer and Fire Support Team (FiST) documents.

E. CHAPTER SUMMARY

This chapter has covered the UFO Translator design, both conceptual and visual, and discussed the logic and flow of the question tree which is pivotal to the creation of the Call for Fire, subsequent corrections, and the Battle Damage Assessment. Shown were snippets of the UFO Translator logic tree and an example of an Adjust Fire mission on a possible stand-alone device. The UFO Translator will initially be able to handle Adjust Fire, Fire for Effect, and Immediate Suppression missions using Grid or Polar methods of target location. The UFO Translator will be able to guide untrained observers through these missions regardless of what equipment they carry, and the equipment they have on hand will determine the types of questions asked. The chapter concluded with recommendations for extending the utility of the UFO Translator tool by incorporating both a training and a planning mode. At this time, personnel trained to conduct Calls for Fire make up less than 0.2% of both the Army and Marine Corps (US Army, 2012; US Marine Corps, 2012). With the distribution of an application like the UFO Translator, that number would drastically increase,

giving virtually every Soldier and Marine the capability to request indirect fire and destroy, neutralize, or suppress enemy targets.

IV. DEVELOPMENT

This chapter discusses the development of a JavaScript prototype used to do a pilot study at the Naval Postgraduate School as well as a recommendation for how to conduct a full-scale development of the UFO Translator once a functioning application is available for testing.

A. PILOT STUDY

The primary purpose of the UFO Translator is to assist untrained observers in conducting Call for Fire missions in combat and non-combat environments. A full-scale test will ultimately need to be conducted with a random sample of untrained observers during a live fire exercise in order to verify and validate the UFO Translator. Prior to this test, however, it is useful to plan for test parameters and conduct a pilot study to work out some of the bugs and determine its readiness for a field test. This section discusses a pilot study conducted at the Naval Postgraduate School in 2012.

1. Test Objectives

Usability is the measure of ease with which particular users can employ a tool or other human-made object in order to achieve a goal. The UFO Translator is designed to assist untrained observers in performing Call for Fire missions—a task that untrained observers are generally unable to perform without assistance—and to do it in a time that is comparable to trained observers and without any prior system training or CFF training. To validate and verify that the system meets these goals, we evaluated the following objectives:

Reliability:	Does the system work when the participant uses it?
	Is the logic of the questions appropriate to conduct a CFF mission?
	Does the user trust the device to provide accurate results?
	How many errors were made?
Availability:	Was the user able to access all functions quickly and efficiently?
Maintainability:	Were there any software or device malfunctions?
	If so, was the user able to diagnose and correct any problems in a timely manner?
Interoperability:	Was the user able to execute a CFF?
	Was the user interface intuitive?
Supportability:	Can an untrained observer use the application effectively?

Table 18. Pilot study objectives (After Defense, 2005).

The following specific test objectives were used to determine system usability:

Determine if the user can complete a designated mission (efficiency, error rate).
Measure time to complete each designated mission over iterative missions (efficiency).
Determine amount of errors users produce that fail to execute fire missions (error rate).
Determine user ability to navigate back to previous input screens (learnability).
Determine if system provides sufficient interaction methods (user satisfaction).
Determine if application is sufficient to engender user confidence and reliability (user satisfaction).

Table 19. Specific pilot study objectives.

2. Participants

As discussed in Chapter II, the UFO Translator is intended for "untrained" observers: Military personnel with no formal Call for Fire training. Examples of non-trained personnel that may need to perform CFF missions include troops on patrol, reconnaissance Marines and Soldiers, convoy personnel that are attacked, and intelligence analysts observing enemy from an Unmanned Aircraft

System (UAS) video feed. The personnel mentioned above are required to maintain radio contact with their headquarters element in hostile environments, so it is assumed they know how to operate a radio and are familiar with standard radio procedures.

To accurately represent the intended user population, ideal test participants should be a sampling of the intended user population. This was not possible at the Naval Postgraduate School, but since this was only an informal pilot study to test the logic of the application and usability, we felt that we could still gain valuable information by performing the study. Due to the limited number of ideal participants in our pool of candidates, we selected individuals with diverse backgrounds and diverse military experience to try and compensate for the fact that our participants are likely to be more educated, older, and have a greater number of years of military experience than average intended users. Our participants consisted of an Army Simulation Operations Officer, a Naval Information Warfare Officer, and a Marine Corps Communications Officer.

3. Success Criteria

To test system usability, our results were based on the success criteria below. There is no doctrinal time limit in any publication that states how long it should take an observer to complete a fire mission, and so most units develop their own Standard Operating Procedures (SOP) for this purpose. For our success criterion, “Time to Complete Fire Mission” (see Table 20 below), we used the SOP most commonly used by Marine Corps artillery units.

The following specific test objectives were used to determine system usability:

User completed the fire mission.
User successfully made it to the last screen (with or without errors).
When presented with multiple options, user chose correct option based on the scenario presented.
When asked, "Is this time sensitive?" user chose "no."
When asked to choose mission type, user chose "Fire for Effect."
When asked to choose target description, user chose "armored vehicles" for scenario 1, and "personnel" for scenario 2.
When asked how many, user chose "2" for scenario 1, while any estimated number of personnel was acceptable for scenario 2.
When asked degree of protection, user chose "in the open" for scenario 1, and "in trenches" for scenario 2.
User correctly interfaced with the Fire Direction Center to request fire support.
Used correct radio procedures.
Used correct CFF procedures.
User completed fire mission in a timely manner, based on the following SOP: • Less than 4 minutes = excellent. • 4 – 6 minutes = good. • 6 – 8 minutes = fair. • > 8 minutes = failed.

Table 20. Success criteria.

Based on this criteria, we tested the JavaScript prototype on three participants in order to validate whether the UFO Translator is suitable for further field-testing.

4. Data Collection Methods

This section discusses our methods of collecting data. For this study, we were interested in evaluating the functionality and usability of the application only; the users were not being evaluated. We explain the testing environment and experimental procedures below.

a. Testing Environment

Each participant was given the UFO Translator interface on a laptop computer in a classroom environment (see Figure 38). The laptop display was projected onto a large screen to allow the moderators to view user mouse movements and input selections. A common handset phone was provided to the user to initiate a voice request for CFF to the simulated FDC played by one of the moderators. The setting was in a classroom environment to minimize external distractions.

In the picture below, the participant is in the first row of seats, using the UFO Translator JavaScript prototype on a laptop computer that is projected onto the large screen. Experimenter number one is at the front recording what is said and playing the role of FDC. Experimenter number two is in the second row keeping time, and recording all mouse clicks and errors. Experimenter number three took the photo.

Figure 38. Pilot study testing environment (photo taken by Experimenter #3).

b. Experimental Procedures

The participants were first asked to provide some basic demographic information, and they were given a sheet of paper describing the purpose of the UFO Translator and the purpose of the study. Absolutely no training or instruction was given on how to operate the UFO Translator or on how to conduct a Call for Fire. The participant was then asked to read a short scenario (see Appendix A), which explained that they were at an observation post and had spotted some enemy tanks and their Commanding Officer wanted them to use the UFO Translator to destroy the tanks. Once the participant finished reading the scenario and started using the UFO Translator, the moderator started keeping time.

During the test, in addition to keeping time, moderators observed the participant as he/she navigated through the screens to identify any confusion, errors, or mistakes made by either the user or the system. Immediately after

completing the initial test scenario, the moderator provided the user with a second test scenario that was similar to the first but used personnel in trenches as the enemy target rather than tanks. The experimenters wanted to test learnability by seeing if time to complete the second scenario was faster than the first scenario. Once the participant reached the voice portion of the scenarios where they are required to send the Call for Fire to the FDC over a radio, a phone receiver was used to simulate a radio handset and the moderator played the role of FDC to respond to the user's radio transmissions.

Once the mission was completed and the participant reached the last screen of the UFO Translator, the moderator stopped and recorded the time. Immediately after scenarios were completed, the participants filled out a survey questionnaire consisting of both Likert Scale questions and short-answer questions (see Appendix A).

5. Usability Tasks

The following tasks were executed by the participants to allow data collection for analysis to assess usability test objectives.

1. Fill out form with demographic information.
2. Read the form that explains the purpose of the study.
3. Read the form that explains the first scenario.
4. Answer questions asked by the UFO Translator.
5. Contact the FDC using a simulated radio handset and perform a voice Call for Fire (FDC played by moderator).
6. Read the Battle Damage Assessment to the FDC.
7. Navigate to the last screen (with or without errors).
8. Read the second scenario and repeat steps 4 through 7.
9. Fill out end of study survey questionnaire.

Table 21. User tasks.

6. Moderator Tasks

For each participant, the moderator performed the following tasks:

1. Give the participant the demographic sheet to fill out.
2. Give the participant a form explaining the purpose of the study.
3. Give the participant the first scenario (Appendix A).
4. Time how long it takes the participant to complete the mission.
5. Observe any mistakes or navigation errors.
6. Record procedural mistakes made during the voice portion of the Call for Fire.
7. Repeat process using another scenario.
8. Ask participant to complete a survey.

Table 22. Moderator tasks.

7. Findings

The most significant finding of the study, and the finding that provides the most evidence for validation of the system, is that all three participants were able to complete the two fire missions (scenarios) and make it to the last screen of the UFO Translator without any training or instruction on how to use the system or on how to do a Call for Fire. The second most significant finding is the time it took each participant to complete the scenarios. It is important that untrained observers be able to complete fire missions in about the same amount of time that it takes trained observers. Time was recorded when the participant began using the UFO Translator and ended when the participant reached the last screen, and was evaluated based on the following criteria:

- Less than 4 minutes = excellent.
- 4 – 6 minutes = good.
- 6 – 8 minutes = fair.
- > 8 minutes = failed.

On average, it took the participants 5 minutes and 5 seconds (5:05) to complete the first scenario which places them in the “good” range; a very impressive time considering they had never seen the UFO Translator before, were unfamiliar with CFF, and were given no instruction on how to use the system. On the second scenario, participants averaged 3 minutes and 24 seconds (3:24), which is considered “excellent.” From the first trial to the second trial, participants improved their times by an average of 1 minute and 41 seconds, which was most likely due to learnability. This also indicates that while users can perform Call for Fire missions with no training and no instruction on how to use the UFO Translator, some familiarization with the system prior to using it for the first time would benefit the user and improve mission completion times, which could be a significant factor during actual combat operations.

Based on the survey findings, participants were generally pleased with the following: Font size, ability to navigate forward and backward at all times, the simple and easy to understand questions, their ability to use the device without any training, how easy the system was to use, and their overall satisfaction. One participant answered “neutral” to the question, “The layout of the menu bars was confusing” and explained in his/her comments that this is because he/she is used to reading from the top down, and on some screens, the instructions are located at the bottom of the screen in the Feedback Box. The design team acknowledges that having feedback at the bottom will slow down some users the first time they use the system, but after even one use, the layout will become intuitive. One user answered “agree” to the question, “At times I felt confused and/or overwhelmed,” and the experimenters believe he/she is referring to one screen in particular that asked the user to tap on the screen, but this functionality has not yet been implemented in the prototype, but will be implemented on the final product.

8. Redesign

One of the trends noticed during the study was that participants were unsure of how to answer the question, “Is this time sensitive?” This question is

asked to determine whether an Immediate Suppression mission is warranted or a standard Fire for Effect mission. The expected answer was “no” since it was explained in the scenario that the enemy targets were not shooting at the users and that the targets did not appear to see them. Despite these clues, two of the users answered “yes” to that question. This initiated our first redesign of the system. To avoid confusion on this question in the future, we changed the question to ask, “Are you under attack?” This question is more straight-forward and should avoid user confusion in the future. In the figure below, the original question is on the left and the new question is on the right.

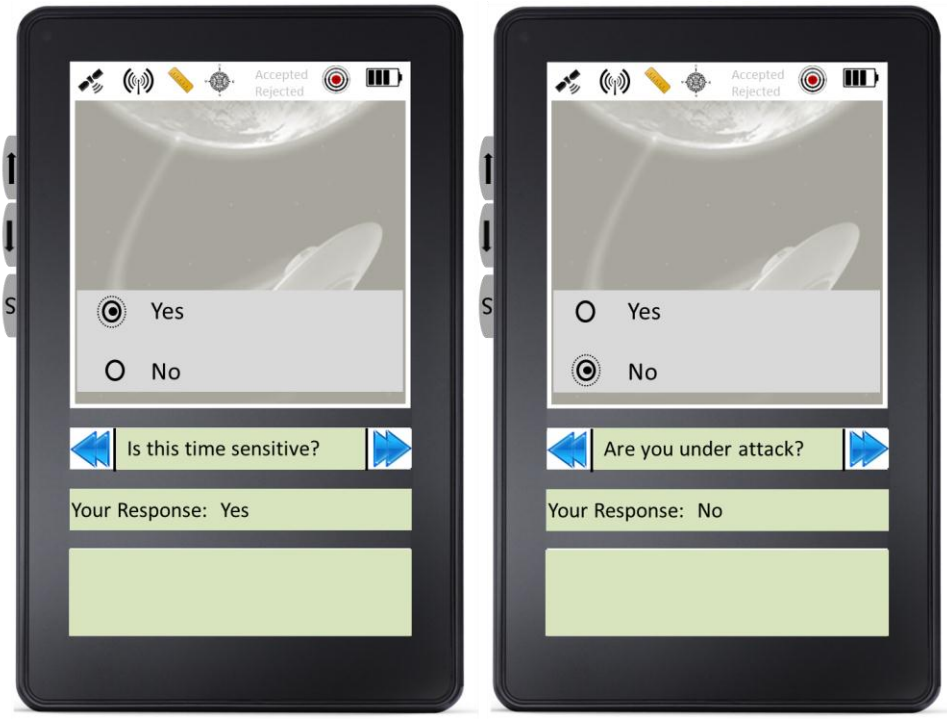

Figure 39. First redesign.

Another issue occurred when one of the users accidentally forwarded through a screen where they were supposed to send the target location to the FDC. We believe this mistake happened because all of the voice screens looked similar and had the same color background, causing the user to think he/she had already transmitted that screen to the FDC. To avoid this confusion in the future, all of the voice screens now have different background colors and are labeled: 1

of 4, 2 of 4, 3 of 4, and 4 of 4. Figure 40 shows what the first two voice screens looked like before the redesign, and Figure 41 shows them after the redesign.

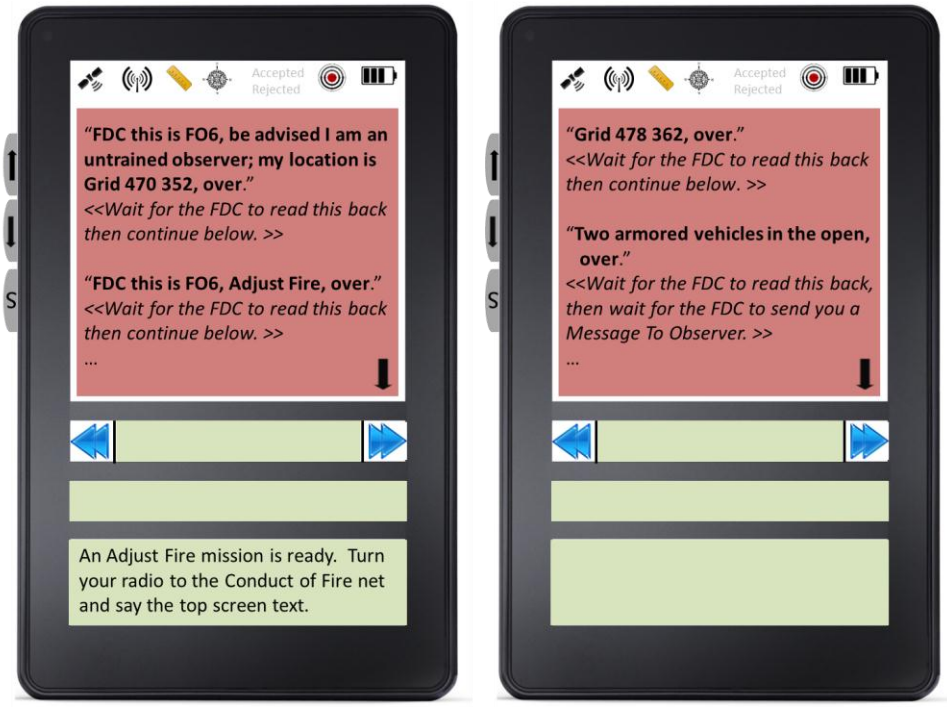

Figure 40. First voice screens before redesign.

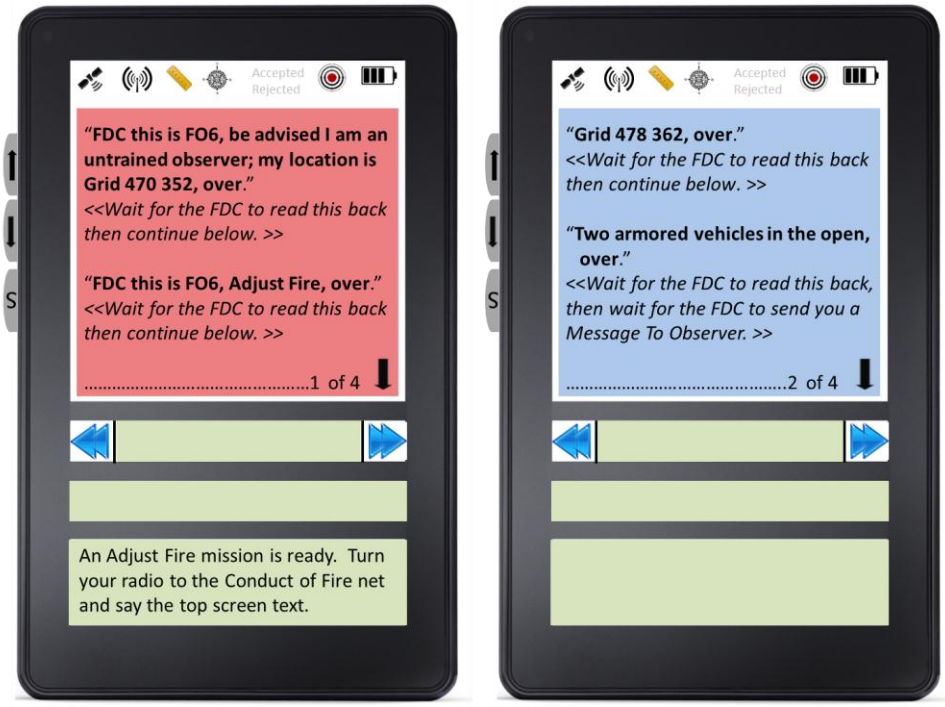

Figure 41. First voice screens after redesign.

9. Pilot Study Summary

No definitive conclusions can be drawn from this informal pilot study because there were so few participants, the participants were not representative of the user population, and the study was performed in a classroom environment. Despite these limitations, we obtained valuable information from the pilot study, listed here:

- All questions necessary to gather the information contained in a standard Call for Fire are present in the application.
- The users in our study were able to finish a Call for Fire in a time comparable to trained observers.
- Screens that were confusing were redesigned.

More testing should be conducted to determine if the application is usable by all military members, and if the performance times are still comparable to trained observers when using live rounds.

B. RECOMMENDED TESTING

This section outlines recommendations for further development and testing of the UFO Translator. Using the analysis and design concepts discussed above, this iterative process should use a series of prototypes and engineering models to measure the operational effectiveness and suitability of the UFO Translator for CFF. Once the Developmental Test and Evaluation (DT&E) and Operational Test and Evaluation (OT&E) is complete, full rate production could be initiated and the UFO Translator disseminated to the fleet. Incremental development should continue if there is a need for upgrades or modifications. Figures 42 and 43 illustrate the DT&E and OT&E processes, respectively.

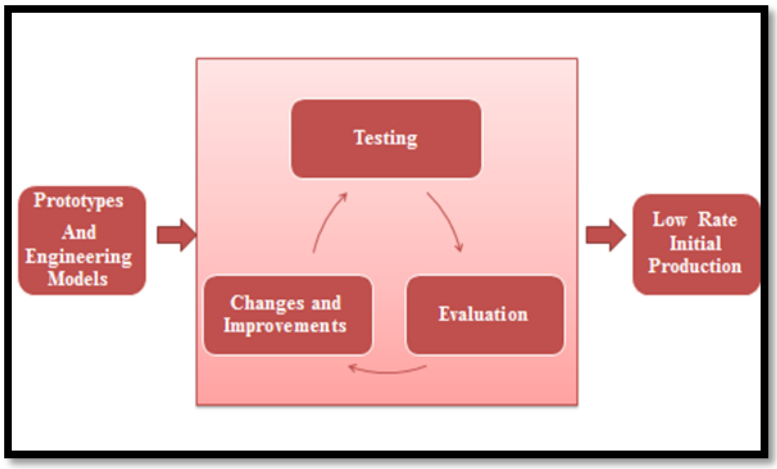

Figure 42. Developmental Test and Evaluation (After Defense, 2005).

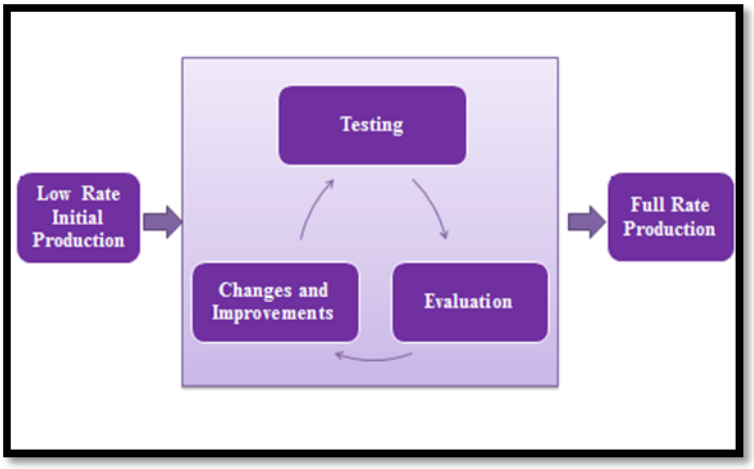

Figure 43. Operational Test and Evaluation (After Defense, 2005).

1. Developmental Process

Creating the UFO Translator application will be a multifaceted and involved process to ensure a quality product is delivered to the user. Prior to programming, a team of script writers and CFF Subject Matter Experts (SME) should write the storyboard sequence and the functionality of each mode based on the design outlined in Chapter III of this thesis. Graphic artists and audio technicians could be hired to create the visuals and sounds for the software. Finally, a team of computer programmers should develop the first prototype of the UFO Translator software. These initial prototypes should be used on computers. Once the first stages of DT&E are completed, an engineering model should be constructed, placing the software on a Commercial-Off-The-Shelf (COTS) smartphone. Once the product satisfies the DT&E requirements, and a stand-alone version of the application has been approved, an initial low rate production of the UFO Translator should take place. These devices could be used in the OT&E process.

a. Developmental Test and Evaluation

During Developmental Test and Evaluation (DT&E), the software and hardware (if a stand-alone device is developed) should undergo testing and

formative evaluations by the development team, system engineers, technicians, Human System Integration (HSI) practitioners, SMEs, and users. Involving different perspectives during this process is a strategic approach that guarantees all aspects of the UFO Translator are closely scrutinized and checked. Specifically, DT&E will verify the UFO Translator's technical performance and usability.

System engineers should conduct technical reviews and quality control of the system's functions, processes, requirements, and specifications (Defense Acquisition College, 2005). Since the UFO Translator will be used in austere environments, it is important that the hardware chosen be able to withstand extreme temperatures, weather, and rough handling. System engineers and technicians should conduct a series of durability tests on the COTS hardware to determine material strength and endurance.

HSI practitioners should verify the design accounts for all human factors issues to ensure the UFO Translator is easy to use, accurate, consistent with operational practices, and able to facilitate use by an inexperienced observer. To accomplish this, a team of CFF SMEs should examine the application to pinpoint flaws in the software or logic of the questions. SMEs will determine whether the applications objectives are well designed and provide the necessary information to enable an untrained observer to conduct a CFF mission. Additionally, the SMEs should closely examine the procedures, tasks, and sequences to verify its compliance with current directives, standard operating procedures, doctrine, and rules of engagement. Untrained observers should participate in usability tests to demonstrate the software's ease of use, transfer of training, and verify whether they can successfully conduct an actual CFF mission (DoD, 2001). SMEs and user feedback should be collected and analyzed to make appropriate changes to the UFO Translator. Based on the DT&E results, feedback, and improvements, the developmental team can verify that the UFO Translator's software and hardware satisfy the technical standards and performance requirements.

b. Operational Test and Evaluation

During Operational Test and Evaluation (OT&E), the effectiveness and suitability should be demonstrated and assessed in the intended operational environment. Figure 44 illustrates the hierarchy of factors addressed during the OT&E (Defense, 2005). Testing of the UFO Translator should be conducted in a training environment prior to the application's use in a wartime environment. Until the device has been fully validated and verified, it is dangerous to use in real missions where lives are at stake. Training conditions, however, should simulate wartime conditions as much as possible during testing (Defense, 2005).

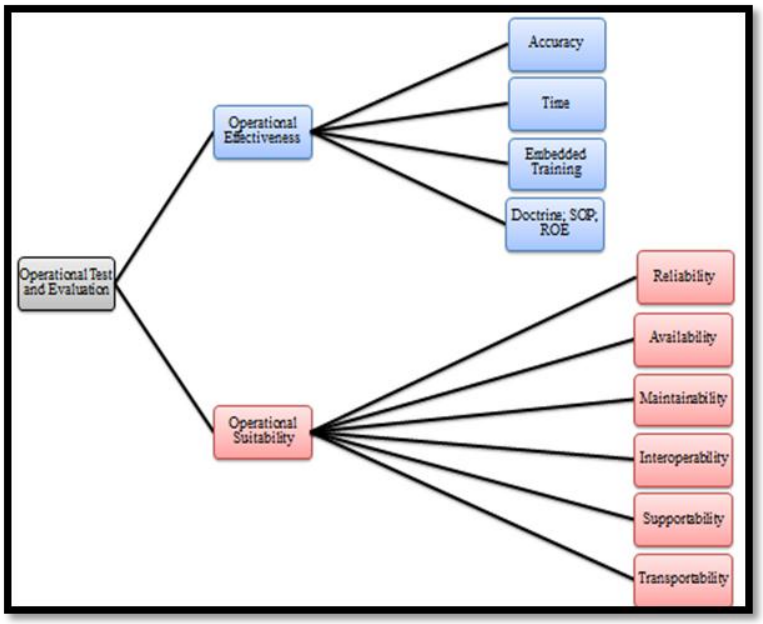

Figure 44. Hierarchy of OT&E factors (After Defense, 2005).

After extensive research, it was found that the Marine Enhanced Mojave Viper (EMV) exercise may provide a setting that satisfies the UFO Translator's OT&E criteria. EMV is a thirty day pre-deployment training exercise that prepares Marine operational units for the combat arms missions they may face while in theater (Marine Corps Air Ground Combat Center, Twentynine Palms, 2011). Conducted in Twentynine Palms, California, EMV simulates a joint battlefield

setting and conducts tactical live-fire scenarios involving role players, Military Operations in Urban Terrain (MOUT) facilities, aircraft, ground vehicles, and a vast array of training tools (I/ITSEC, 2012). It is as close to the "real thing" as an exercise can get.

To determine the UFO Translator's mission effectiveness, a summative evaluation of its embedded functionality, its influence on mission completion, and integration with the established tactical doctrine, SOPs, and ROEs while on the battlefield should be conducted (Defense, 2005). In order to do this, performance data should be collected on three different conditions shown in Table 23:

Condition 1:	Marines that are trained observers (group 1) will not use the UFO Translator. Their performance on CFF accuracy and time to complete will be assessed and the results set as the performance baseline.
Condition 2:	Marines that are untrained observers (group 2) will not use the UFO Translator. Their performance on CFF accuracy and time to complete will be assessed. Performance during this condition should be lower than performance during condition 1.
Condition 3:	Marines that are untrained observers (group 3) will use the UFO Translator. Their performance on CFF accuracy and time to complete will be assessed. If the application is developed correctly, performance during this condition should be greater than condition 2.

Table 23. OT&E testing conditions.

To ensure validity, each group should receive the same scenario, and be told that the most junior observer will conduct the CFF. Although this application can be used by all experience levels, it is designed for untrained observers, which is why the study focuses on those with limited experience. As much as possible, evaluators recording accuracy and time to complete mission should not be told which condition each Marine is a member of to avoid experimenter bias. The abilities and knowledge of junior observers will vary from unit to unit, so these studies should be conducted several times to increase the sample size. Acquiring a large sample will not be a problem since the EMV exercise is

conducted eight times per year with more than 4,100 Marines participating (Marine, 2011). The frequency and the size of the EMV give the developmental team the flexibility to evaluate many units under these three conditions. The results of the study will answer the following questions regarding effectiveness:

Does the group with the UFO Translator perform better than either of the groups without it?
How does the performance of the group with formal training compare to the groups without formal training?
Can an untrained observer use the UFO Translator and successfully conduct a CFF while engaged in battle?

Table 24. Validation questions.

By answering these questions, the developmental team can validate whether the UFO Translator “performs as intended” (Defense, 2005).

The development team should conduct several suitability assessments to ensure the human element is at the center of the design. These assessments should concentrate on the reliability, availability, maintainability, interoperability, supportability, and transportability of the system. Executing the suitability testing should consist of observational analysis of the EMV and a survey on user satisfaction. The survey should consist of a Likert Scale to answer questions regarding the functionality and usability of the application. A comment section should be placed at the end of the survey to allow the Marines to speak freely on any recommendations. Observations and feedback should be used to answer the following questions, similar to the questions used in the pilot study discussed at the beginning of this chapter (Defense, 2005):

Reliability:	Did the system work when the observer needed it and in all conditions? Is the embedded logic accurate? Does the user trust the device to provide accurate results? How many errors were made?
Availability:	Was the user able to access all functions quickly and efficiently?
Maintainability:	Were there any software or device malfunctions? If so, was the user able to diagnose and correct any problems in a timely manner?
Interoperability:	Was the user able to execute a CFF to air, ground, and ship assets? Was the software accessible over all devices?
Supportability:	Can the untrained observer use the application effectively?
Transportability:	Was the user able to carry and use the device without strain, pain, or discomfort?

Table 25. Suitability assessment questions (After Defense, 2005).

By answering these questions, the developmental team can validate whether the UFO Translator is suitable and safe for the user.

2. Concerns

Although the developmental phase is well defined, there are still several concerns. First, this developmental approach does not take the schedule or budget into consideration. The team would like to complete as many iterations as possible, but realistically this may not be possible. If the development phase is shortened due to time and money constraints, it is imperative that the team incorporate an effective and efficient management process to include: Risk management, quality management, and configuration management.

Although the EMV exercise is very helpful to OT&E, there are two limitations. First, EMV is a Marine exercise and the system will be operationally tested without Army assistance. The developmental team recognizes this issue and believes it will not cause a problem since Army SMEs are actively engaged in the DT&E process. Additionally, CFF is standardized amongst the Army and

Marine Corps, so if the device works for one, it should work for both. Second, EMV uses simulated targets that do not move, so we cannot test the system against moving targets. Again, the developmental team is aware of this but feel that this will not hinder the OT&E evolution.

3. Platforms

As a computer program, the UFO Translator can be used on a variety of platforms, from portable devices to desktop computers. It may also be useful to create an online application that provides a visual representation of the UFO Translator and an overview of the system. The online version could include screen shots of the actual system, training objectives and plans (if any), and a user's guide. The online version could be available through each service's Knowledge Online website for users with access. The benefits of the online version will be a means for garnering user feedback at the beginning stages of implementation and the use of Knowledge Online as public affairs outlet for the program.

Next, we recommend UFO Translator software applications be issued to individual Soldiers, Marines, and units that require CFF capability. As part of the in-processing procedures, the application could be issued to applicable service members upon arrival to their duty station as an "accountable" item. Each unit should also receive a UFO Translator (either as a software application or an actual device if a stand-alone version is developed) through the supply system for both operational and training purposes.

4. Possible Areas of Risk

Once UFO Translator implementation has been fully realized, designers and leaders should ensure there is little to no interruption of daily operations by the use of the application. Separate, in-depth analysis should be accomplished to determine how to best measure effectiveness of the UFO Translator once it has been fielded.

C. CHAPTER SUMMARY

This chapter discussed a pilot study conducted at the Naval Postgraduate School in 2012, and a recommended full-scale test and evaluation once the application is fully developed. Findings from the pilot study showed that all of the questions necessary to conduct a Call for Fire are in place, users can complete fire missions in a reasonable amount of time, and users are generally pleased with the user interface. For full-scale testing, the Enhanced Mojave Viper exercise in Twentynine Palms, CA is an ideal location to perform Operational Tests and Evaluations. The environment and training conducted at Twentynine Palms is very realistic and there is a plethora of untrained personnel to help with testing.

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V. CONCLUSIONS

Using indirect fire in combat can be a force multiplier and have decisive effects on battles and engagements, and Calling for Fire is the procedure used to request indirect fire. It is a perishable skill, however, if not practiced regularly and there are currently no simulators or applications in the military arsenal to help untrained observers conduct Call for Fire missions. This document provided the description and design of an application, the UFO Translator, that has the potential to fill this need. Although formal classroom training can be conducted and is encouraged, the UFO Translator is designed to be used by any military member, regardless of their rank, billet, or proficiency in Call for Fire. The UFO Translator can be an essential tool for units that do not have trained forward observers in their organization. It brings a great deal of firepower and flexibility in operations to units that did not previously have these abilities. This application improves mission capabilities and has the potential to save lives.

A. RESULTS

In Chapter I, several questions were posed that guided the direction of this research. The answers to those questions are summarized here.

1. Can a software application be designed to assist untrained observers in performing Call for Fire?

As mentioned above, untrained observers may need to conduct Call for Fire missions, and since most untrained observers do not possess this skill, this first question is quite possibly the most important. Regardless of how fast, how procedurally correct, or how thorough the request, an untrained observer must first be able to complete a Call for Fire mission and put rounds on target. As discussed in Chapter III, the UFO Translator has all the necessary questions in place to retrieve the required information from the observer to conduct a Call for Fire mission. Based on their answers, the logic of the UFO Translator guides

them through from beginning to end, telling them exactly what to say to the FDC, and what actions to take to achieve the desired effects on target.

2. Can the system be used by any military member, regardless of rank, billet, or experience?

To fully answer this question, more testing must be conducted with a larger and more diverse sample of untrained observers. Our preliminary results from the pilot study discussed in Chapter IV, however, are promising. The participants in the pilot study, while most likely older and more educated than the intended users of the application, had absolutely no experience with Call for Fire previously, and had never seen the UFO Translator prior to their participation in the study, were all able to complete two fire missions. In addition, there are procedures in place in the Fire Direction Center for dealing with untrained observers. If a user for some reason is not able to answer a question on the UFO Translator, they can ask the FDC for additional guidance. This is, of course, not desirable, since walking an untrained observer through the required information takes time that the FDC may not have. Therefore, it is essential that the UFO Translator be fully tested and made usable for even the most junior Marines and Soldiers.

3. Will the UFO Translator help untrained observers perform Call for Fire faster than the manual methods?

Since most untrained observers would likely not even be able to complete a Call for Fire without assistance, this question is trivial on the surface. Even observers with a little training and the ability to complete a fire mission would most likely not be able to do it as quickly on their own as with the UFO Translator. However, a poorly designed aide could in fact be detrimental or misleading. The utility of the tool was made evident in the pilot study as all three participants completed their first mission between four and six minutes, which is considered “good,” even for trained observers. Further, all three participants completed their second mission in less than four minutes, which is considered “excellent.” The UFO Translator can definitely help untrained observers perform

Call for Fire faster than manual methods, and could be a helpful tool for newly trained observers as well.

4. Will the UFO Translator help untrained observers perform Call for Fire in a reasonable amount of time comparable to trained observers?

As discussed in the previous paragraph, participants in the pilot study completed their first mission between four and six minutes and their second mission in less than four minutes. These results suggest the tool holds significant potential for small units that do not have trained forward observers within their manning. Specifically, although trained observers are much more skilled in specialty missions such as Suppression of Enemy Air Defense (SEAD), Smoke, Illumination, and Shift from a Known Point, the results of the pilot study are very promising in that untrained observers can perform basic Adjust Fire, Fire for Effect, and Immediate Suppression missions in a reasonable amount of time comparable to trained observers.

B. FUTURE WORK

Future work should focus on making the application available on multiple platforms—portable devices, a stand-alone device, and laptop/desktop computers; creating a Training Mode to help with teaching Call for Fire to untrained observers and a Planning Mode to store target plans, schedules, and information related to the enemy; incorporating Naval Gunfire and Close Air Support (CAS) 9-line Briefs; including additional missions such as SEAD, Smoke, Illumination, and Shift from a Known Point; and embedding special tools in the application to help the observer with target location, such as a compass, range finder, GPS, and reticle pattern.

1. Platforms

Ideally, the UFO Translator should be an application that runs on virtually any platform. Soldiers and Marines carry a great deal of equipment on them already, so in an effort to avoid adding weight and another item to their current

load, the UFO Translator should be downloadable onto a device they already carry. Many warfighters carry SMART phones, PDAs, and tablets, so it would be convenient to use the application on one of those devices. Further, since the UFO Translator does not rely on Internet connection, the application can be used virtually anywhere.

With the proliferation of UAVs and satellite imagery, many warfighters can see the enemy from their workstation on a desktop or laptop computer. In the introduction, there was an anecdote of an actual incident wherein a mid-grade non-commissioned officer upon discovering insurgents emplacing IEDs along a well-travelled road requested indirect fire from her workstation to neutralize the threat. The tool described in this thesis seeks to mitigate the coordination difficulties experienced during that incident so as to expedite the delivery of rounds on the target of opportunity. As the UAV community expands and provides more coverage in combat zones, the utility of having the UFO Translator as a program on a desktop and laptop computer is evident.

Finally, the UFO Translator as a stand-alone device would greatly benefit untrained observers because of the target location tools that can be embedded in the system. With the stand-alone device, instead of asking the observer to use their compass to obtain the direction or their range-finder to obtain the range, the user should be able to point the device at the target, click a button, and let the UFO Translator calculate the location information for them. Another useful tool would be to send the Call for Fire as a text message over a radio, rather than by voice, to avoid mistakes and/or misinterpretations.

2. Modes

The initial UFO Translator prototype is designed for operational use only. It would be useful to include a Training Mode and a Planning Mode. With an Operational Mode only, there is a risk that the application will be underused and forgotten when it is needed most. With an embedded Training Mode and Planning Mode, the device will see more use and be useful to untrained (and

trained) observers in non-combat as well as combat environments. Users can use the UFO Translator anytime they have down time and want to learn more about indirect fire and/or practice Calling for Fire. With Planning Mode, users can digitally generate fire planning documents such as Target List Worksheets, Fire Plans, Final Protective Fires, and other pre-planned target information. Planning Mode could be very useful on reconnaissance missions and in planning for offensive and defensive operation.

3. Additional Indirect Fire Agencies

With the current design, the UFO Translator can be used to request Artillery and Mortars only. To improve effectiveness and expand its scope, adding the Naval Gunfire Call for Fire and the CAS 9-Line Brief to the application is a logical next step. Including Naval Gunfire and CAS requests to the application vastly increases the options an observer has for engaging the enemy and places even more firepower at the disposal of units and users that previously had no access to these capabilities. Adding the Naval Gunfire Call for Fire should not be too difficult since it is very similar to the Artillery and Mortar Call for Fire. Most of the questions and logic of the application would remain the same; the biggest difference is that Naval Gunfire is sent in two transmissions rather than three. The CAS 9-Line Brief will be a bit more challenging, but worth the effort considering how much firepower Aviation brings to the engagement.

4. Additional Missions

The current version of the UFO Translator allows users to perform Immediate Suppression, Fire for Effect, and Adjust Fire missions using Grid and Polar methods of target location. While these missions are appropriate for novice observers and sufficient to handle most targets of opportunity, it may be beneficial to incorporate additional types of missions, such as SEAD, smoke (both Quick Smoke and Immediate Smoke), and Illumination (both Continuous and Coordinated), and additional types of commands, such as At My Command, the option of requesting linear and irregular sheafs, and instructions on how to hit

moving targets. The standard sheaf for artillery is a circular sheaf that spreads the rounds from six howitzers in a circular pattern around the target; since not all targets are circular, instructions on how to request linear and irregular sheafs could be incorporated into the application. Adding the above features, however, will only enhance the application if it remains simple enough for use by all personnel.

5. Embedded Tools

One of the great features of the UFO Translator is that an observer can use it to Call for Fire regardless of what equipment they have on hand. Some users will have a map, compass, binoculars, range-finder, etc., but even if they have no equipment, the UFO Translator has the logic in place to know what questions to ask to derive the information needed to make a Call for Fire request. However, if the UFO Translator had all of the location finding tools mentioned above embedded in the system itself, it would save time and make things easier for the observer to request indirect fire. In addition, if the UFO Translator had an embedded map, compass, binoculars, and range-finder, it would eliminate the need to carry these extra items. The user could use the embedded tools to accomplish other tasks, in addition to Calling for Fire.

C. SUMMARY

Using Call for Fire to request indirect fire is a complicated process and difficult to master with no formal training. It is important that untrained observers be able to request indirect fire when it is needed and when no trained observers are available. There are currently no tools in the military arsenal that enable untrained observers to perform Call for Fire, so an application is necessary to fill this gap. The Untrained Forward Observer (UFO) Translator, as outlined in this thesis, could be a viable solution. By determining what equipment users carry and asking them appropriate questions with regard to callsigns, mission type, target location, and target description, the UFO Translator can gather the

information necessary to request indirect fire using the proper Call for Fire format.

Whether the situation calls for an Immediate Suppression, Fire for Effect, or Adjust Fire mission, the UFO Translator can guide the observer through the Call for Fire process, to include the Message to Observer, adjustment of rounds onto target, and the Battle Damage Assessment. The UFO Translator has the potential to increase combat power by expanding the number of personnel capable of requesting indirect fire from less than 1% to nearly 100%, and most importantly, it has the potential to save lives.

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APPENDIX A. PILOT STUDY

Purpose of the Study and Scenarios

Untrained Forward Observer (UFO) Translator

Thank you for participating in this study. We are developing an application called the UFO Translator to help untrained observers perform Call for Fire missions. The purpose of today's study is to test functionality of the prototype and identify any improvements needed for the system. Your feedback is greatly appreciated.

Scenario 1:

You and a friend are manning an Observation Post when you spot two enemy tanks in the distance. The tanks are stationary and do not appear to see you. You report the situation to your Commanding Officer and she tells you to use the UFO Translator to do a Fire for Effect mission and destroy the tanks.

Your callsign: FO6
FDC's callsign: FDC

*******Please do not turn the page over until Scenario 1 is complete*******

Scenario 2:

You and a friend are manning an Observation Post when you spot some enemy troops in trenches off in the distance. They do not appear to see you. You report the situation to your Commanding Officer and she tells you to use the UFO Translator to do a Fire for Effect mission on the troops in trenches.

Your callsign: FO6
FDC's callsign: FDC

Pre-Screening

Demographic Questions:

1. What service are you in?

2. What is your age?

3. What is your military occupation?

4. Do you have any experience with Call for Fire?

   If so, please give a brief description.

*******Please do not turn the page until after the study*******

User Device Questions:

1. The font size was large enough to read easily.

Agree Strongly				Strongly Disagree
1	2	3	4	5

2. I knew how to go forward and backward at all times.

Agree Strongly				Strongly Disagree
1	2	3	4	5

3. The layout of the menu bars was confusing.

Agree Strongly				Strongly Disagree
1	2	3	4	5

4. The questions were simple and easy to understand.

Agree Strongly				Strongly Disagree
1	2	3	4	5

5. At times I felt confused and/or overwhelmed.

Agree Strongly				Strongly Disagree
1	2	3	4	5

6. I could use this device without any training.

Agree Strongly				Strongly Disagree
1	2	3	4	5

7. I am confident I could perform a Fire Mission using this device in a combat situation.

Agree Strongly	Agree	Neutral	Disagree	Strongly Disagree
1	2	3	4	5

8. Overall, how easy was it to use this system?

Very Easy	Easy	Neither Easy Nor Hard	Hard	Very Hard
1	2	3	4	5

9. Overall, how easy was it to understand the questions?

Very Easy	Easy	Neither Easy Nor Hard	Hard	Very Hard
1	2	3	4	5

10. Overall, I would rate this system.

Excellent	Good	Average	Bad	Terrible
1	2	3	4	5

11. What did you like most about the system?

12. What did you like least about the system?

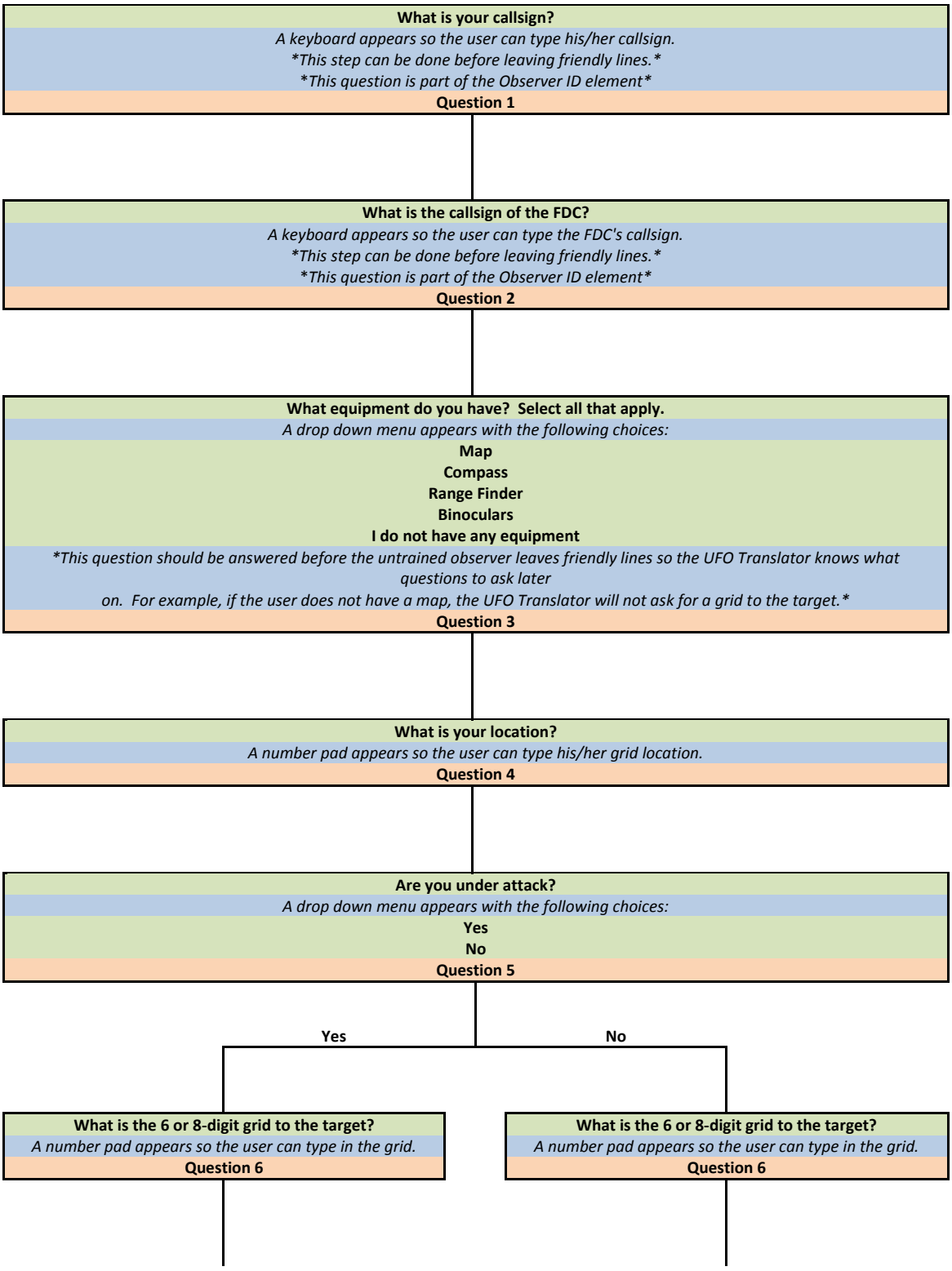
13. What recommendations (if any) would you make to improve this system?

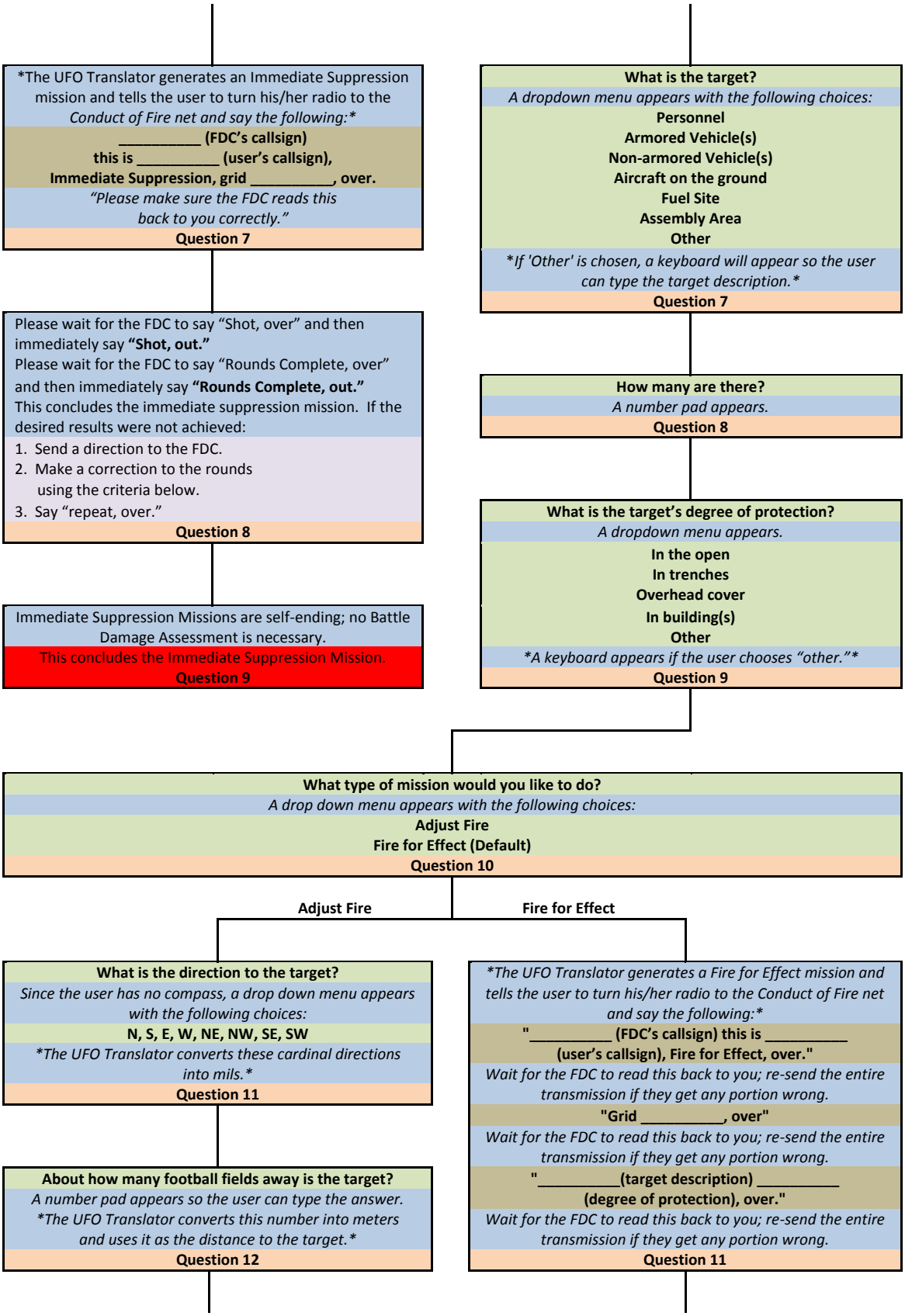
Summary of User Survey Questionnaire

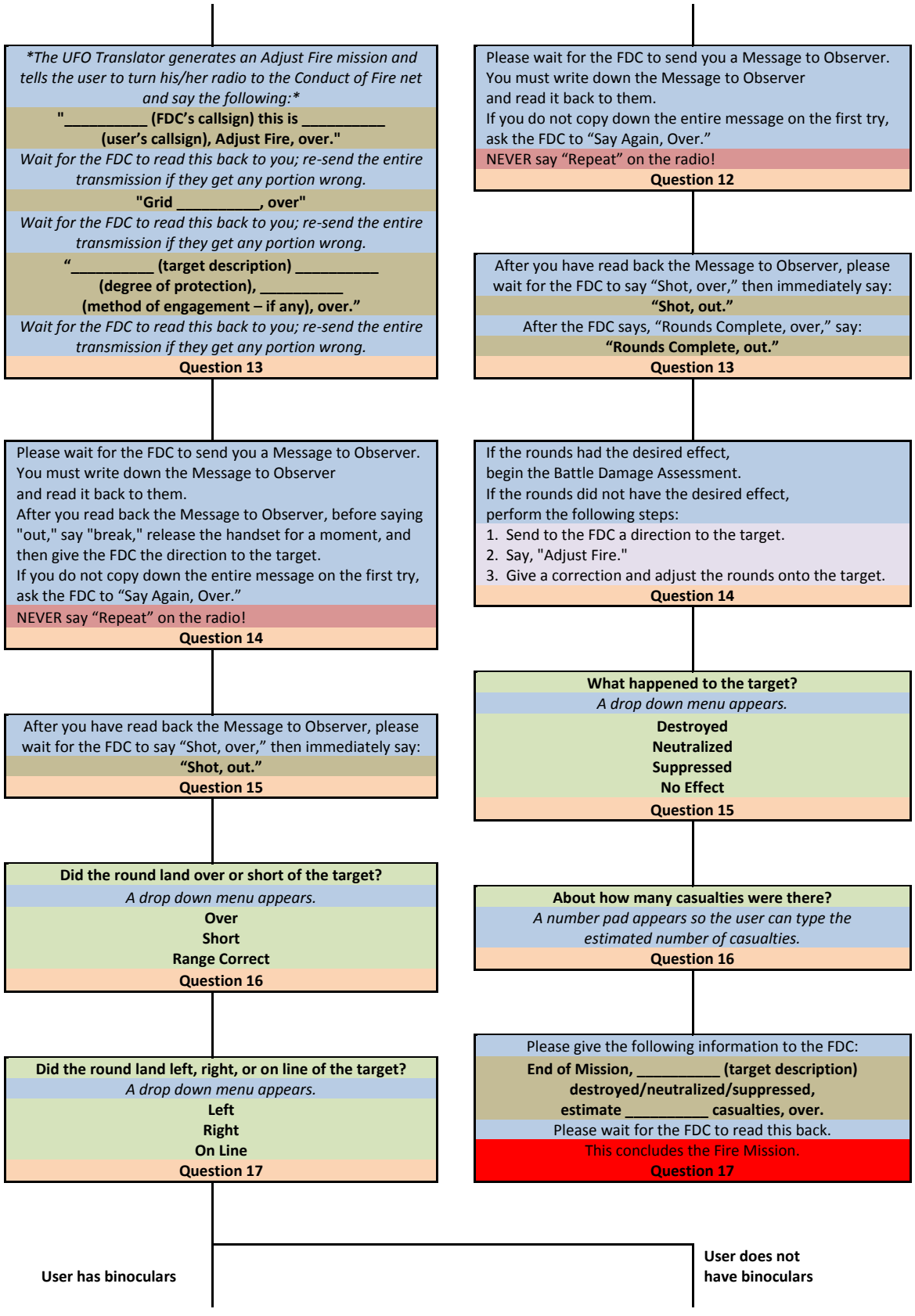
		Subject #1	Subject #2	Subject #3
Duration (min:sec)	Scenario 1	5:19	5:24	4:33
	Scenario 2	3:37	2:56	3:40

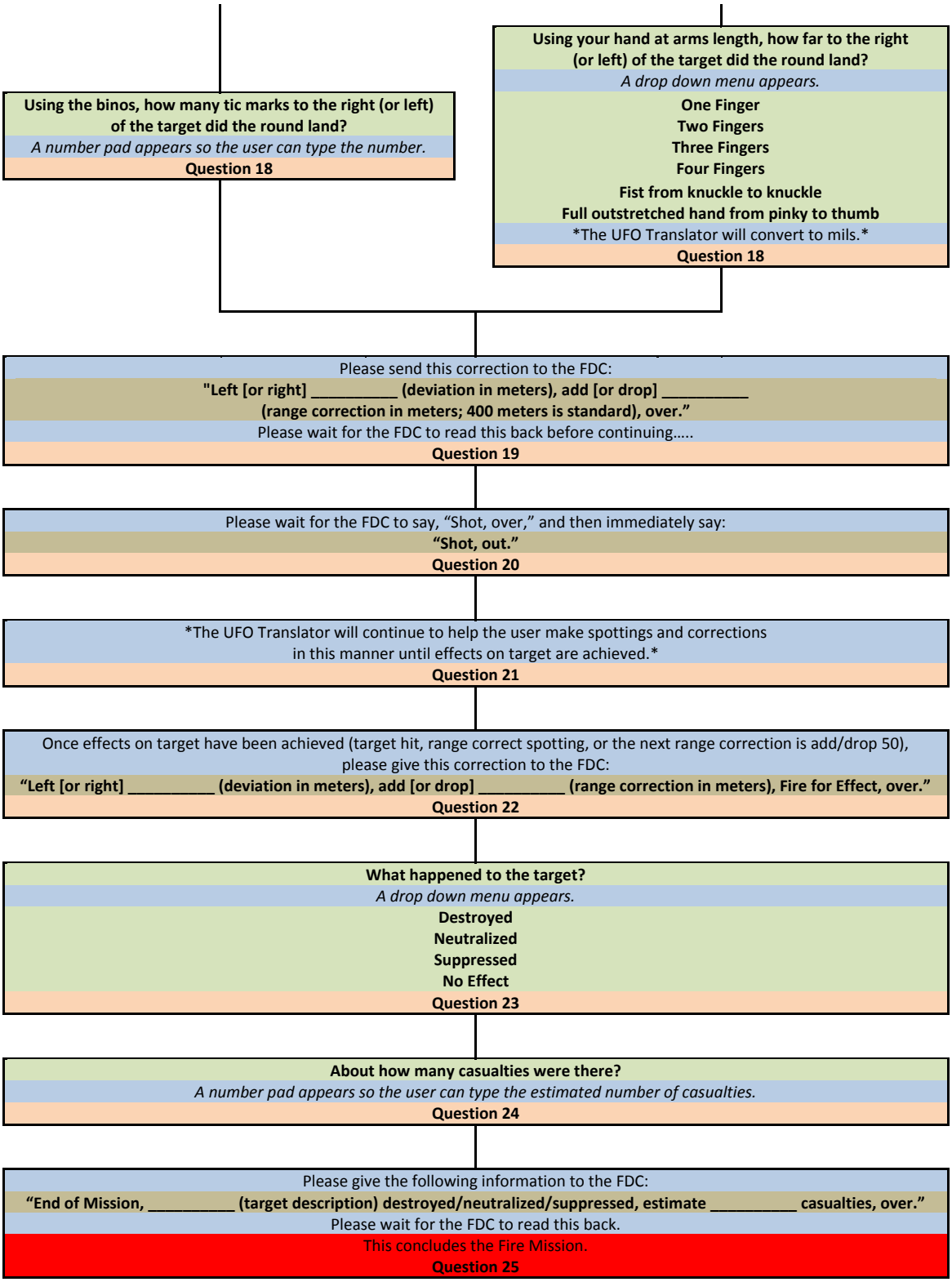
	Question	Subject #1	Subject #2	Subject #3
Demographic Questions	1	US Army	US Navy	USMC
	2	33	37	37
	3	Simulation Operations Officer FA-57	IW	Communications Officer
	4	Yes, FA OBC	Yes, observed NSFS on ship	A little… TBS baby…
User Device Questions	1	2	2	1
	2	2	2	1
	3	4	3	4
	4	2	1	1
	5	2	4	4
	6	2	2	3
	7	2	2	2
	8	2	1	1
	9	2	1	1
	10	2	2	1
	11	Calculated distance to target and fire mission for me.	Told me exactly what to say so I didn't have to think about it.	User interface was designed very well. Images are easy to see & large enough.
	12	How do you know what time sensitive is?	N/A – good job	No comment.
	13	Give a brief description of what destroyed, neutralized, and suppress means. Say 'are there any enemy personnel left; if no, translator knows what to say rather than assuming user knows. Have a different font color for FDC & FO, and a different background color.	Be able to re-focus target crosshairs.	N/A

APPENDIX B. LOGIC TREE—USER HAS A MAP ONLY

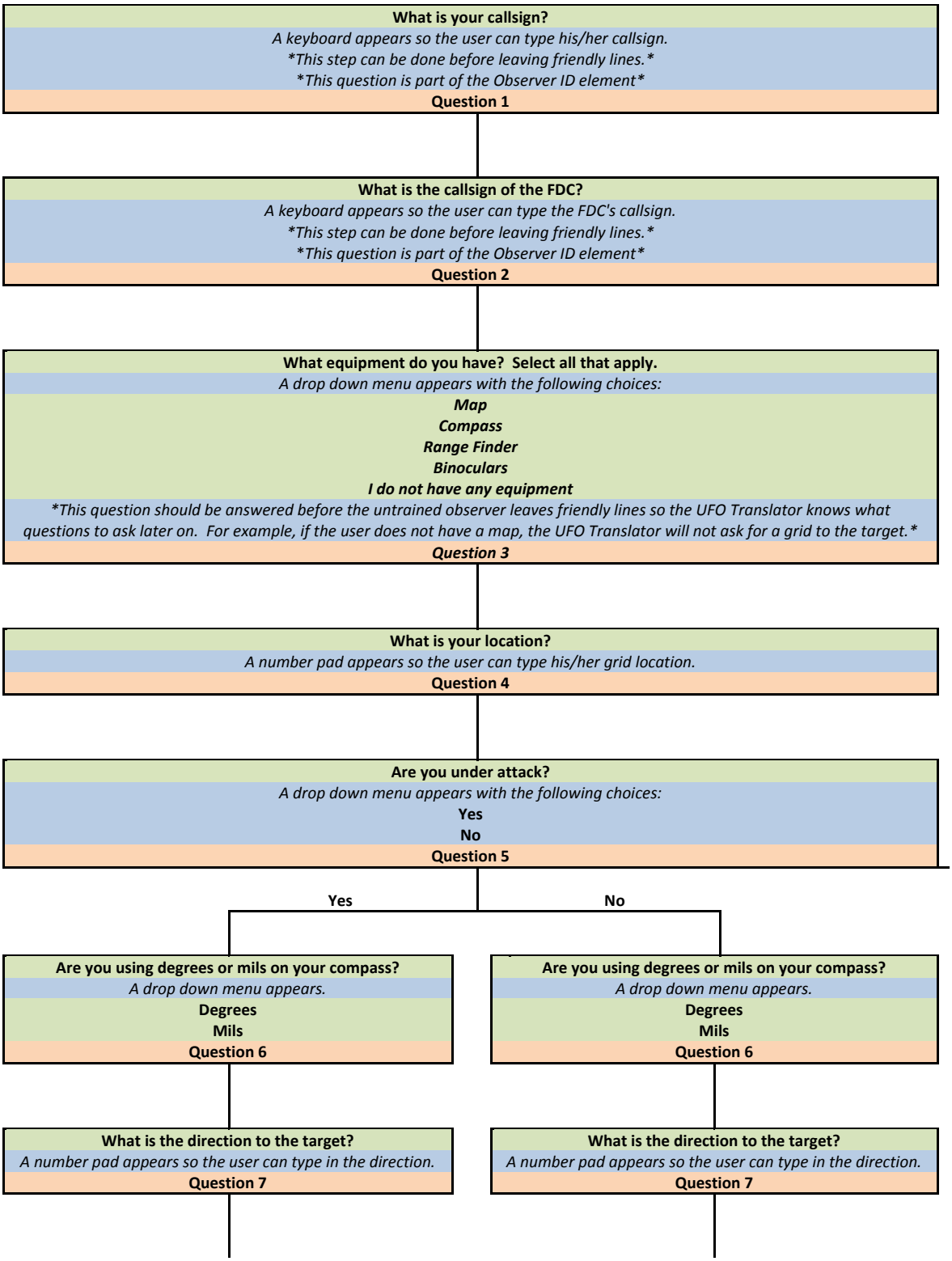


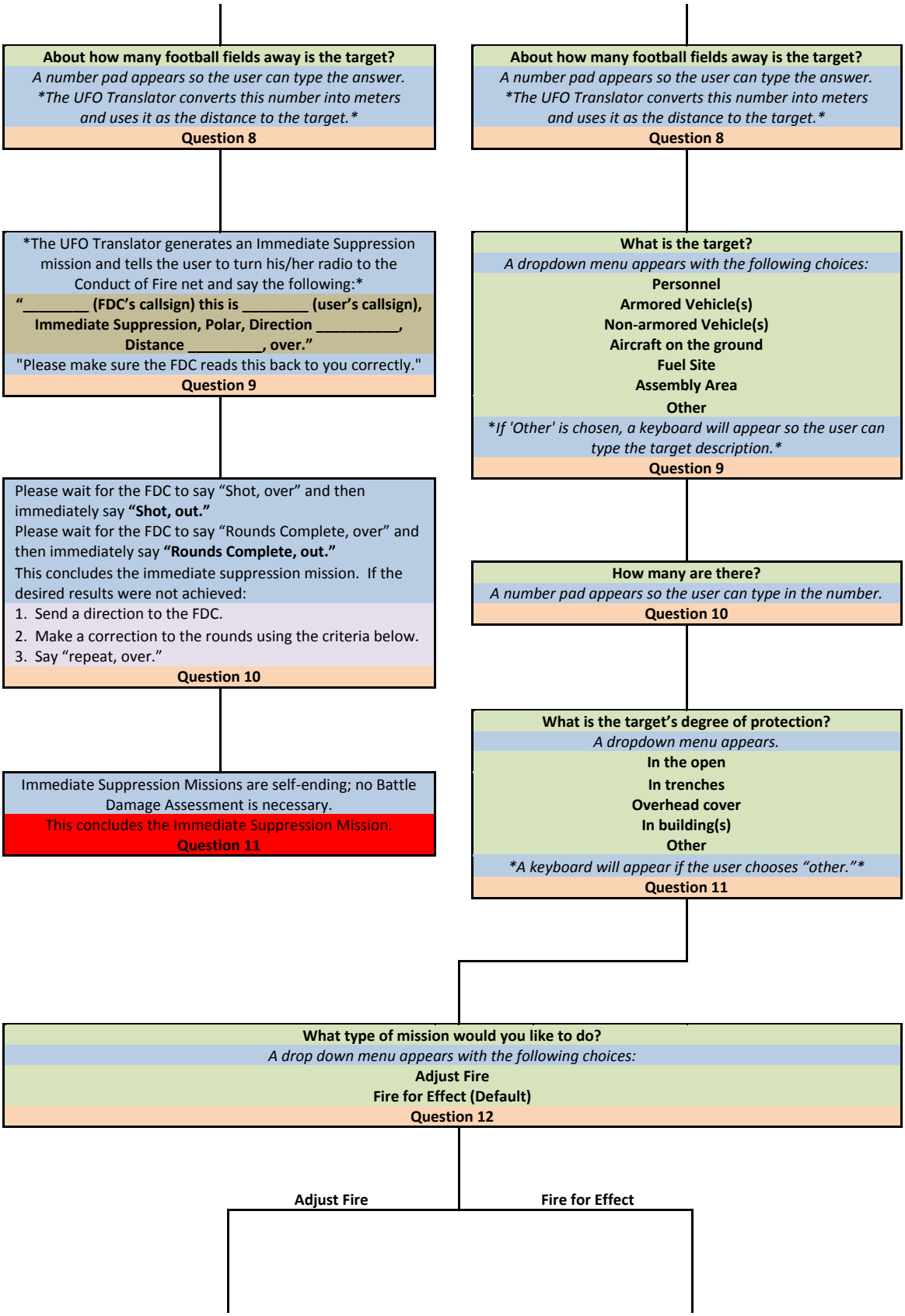

The UFO Translator generates an Immediate Suppression mission and tells the user to turn his/her radio to the Conduct of Fire net and say the following:
_____ (FDC's callsign)
this is _____ (user's callsign),
Immediate Suppression, grid _____, over.
"Please make sure the FDC reads this back to you correctly."
Question 7
Please wait for the FDC to say "Shot, over" and then immediately say "Shot, out."
Please wait for the FDC to say "Rounds Complete, over" and then immediately say "Rounds Complete, out."
This concludes the immediate suppression mission. If the desired results were not achieved:
1. Send a direction to the FDC.
2. Make a correction to the rounds using the criteria below.
3. Say "repeat, over."
Question 8
Immediate Suppression Missions are self-ending; no Battle Damage Assessment is necessary.
This concludes the Immediate Suppression Mission.
Question 9
What is the target?
A dropdown menu appears with the following choices:
Personnel
Armored Vehicle(s)
Non-armored Vehicle(s)
Aircraft on the ground
Fuel Site
Assembly Area
Other
If 'Other' is chosen, a keyboard will appear so the user can type the target description.
Question 7
How many are there?
A number pad appears.
Question 8
What is the target's degree of protection?
A dropdown menu appears.
In the open
In trenches
Overhead cover
In building(s)
Other
A keyboard appears if the user chooses "other."
Question 9
What type of mission would you like to do?
A drop down menu appears with the following choices:
Adjust Fire
Fire for Effect (Default)
Question 10
Adjust Fire
Fire for Effect
What is the direction to the target?
Since the user has no compass, a drop down menu appears with the following choices:
N, S, E, W, NE, NW, SE, SW
The UFO Translator converts these cardinal directions into mils.
Question 11
About how many football fields away is the target?
A number pad appears so the user can type the answer.
The UFO Translator converts this number into meters and uses it as the distance to the target.
Question 12
The UFO Translator generates a Fire for Effect mission and tells the user to turn his/her radio to the Conduct of Fire net and say the following:
"_____ (FDC's callsign) this is _____ (user's callsign), Fire for Effect, over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"Grid _____, over"
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"_____(target description) _____ (degree of protection), over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
Question 11


The UFO Translator generates an Adjust Fire mission and tells the user to turn his/her radio to the Conduct of Fire net and say the following:
"_____ (FDC's callsign) this is _____ (user's callsign), Adjust Fire, over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"Grid _____, over"
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"_____ (target description) _____ (degree of protection), _____ (method of engagement – if any), over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
Question 13
Please wait for the FDC to send you a Message to Observer.
You must write down the Message to Observer and read it back to them.
After you read back the Message to Observer, before saying "out," say "break," release the handset for a moment, and then give the FDC the direction to the target.
If you do not copy down the entire message on the first try, ask the FDC to "Say Again, Over."
NEVER say "Repeat" on the radio!
Question 14
After you have read back the Message to Observer, please wait for the FDC to say "Shot, over," then immediately say:
"Shot, out."
Question 15
Did the round land over or short of the target?
A drop down menu appears.
Over
Short
Range Correct
Question 16
Did the round land left, right, or on line of the target?
A drop down menu appears.
Left
Right
On Line
Question 17
User has binoculars
Please wait for the FDC to send you a Message to Observer.
You must write down the Message to Observer and read it back to them.
If you do not copy down the entire message on the first try, ask the FDC to "Say Again, Over."
NEVER say "Repeat" on the radio!
Question 12
After you have read back the Message to Observer, please wait for the FDC to say "Shot, over," then immediately say:
"Shot, out."
After the FDC says, "Rounds Complete, over," say:
"Rounds Complete, out."
Question 13
If the rounds had the desired effect, begin the Battle Damage Assessment.
If the rounds did not have the desired effect, perform the following steps:
1. Send to the FDC a direction to the target.
2. Say, "Adjust Fire."
3. Give a correction and adjust the rounds onto the target.
Question 14
What happened to the target?
A drop down menu appears.
Destroyed
Neutralized
Suppressed
No Effect
Question 15
About how many casualties were there?
A number pad appears so the user can type the estimated number of casualties.
Question 16
Please give the following information to the FDC:
End of Mission, _____ (target description) destroyed/neutralized/suppressed, estimate _____ casualties, over.
Please wait for the FDC to read this back.
This concludes the Fire Mission.
Question 17
User does not have binoculars


Using the binos, how many tic marks to the right (or left) of the target did the round land?
A number pad appears so the user can type the number.
Question 18
Using your hand at arms length, how far to the right (or left) of the target did the round land?
A drop down menu appears.
One Finger
Two Fingers
Three Fingers
Four Fingers
Fist from knuckle to knuckle
Full outstretched hand from pinky to thumb
The UFO Translator will convert to mils.
Question 18
Please send this correction to the FDC:
"Left [or right] _____ (deviation in meters), add [or drop] _____ (range correction in meters; 400 meters is standard), over."
Please wait for the FDC to read this back before continuing.....
Question 19
Please wait for the FDC to say, "Shot, over," and then immediately say:
"Shot, out."
Question 20
The UFO Translator will continue to help the user make spottings and corrections in this manner until effects on target are achieved.
Question 21
Once effects on target have been achieved (target hit, range correct spotting, or the next range correction is add/drop 50), please give this correction to the FDC:
"Left [or right] _____ (deviation in meters), add [or drop] _____ (range correction in meters), Fire for Effect, over."
Question 22
What happened to the target?
A drop down menu appears.
Destroyed
Neutralized
Suppressed
No Effect
Question 23
About how many casualties were there?
A number pad appears so the user can type the estimated number of casualties.
Question 24
Please give the following information to the FDC:
"End of Mission, _____ (target description) destroyed/neutralized/suppressed, estimate _____ casualties, over."
Please wait for the FDC to read this back.
This concludes the Fire Mission.
Question 25

APPENDIX C. LOGIC TREE—USER HAS A COMPASS ONLY




About how many football fields away is the target?
A number pad appears so the user can type the answer.
The UFO Translator converts this number into meters and uses it as the distance to the target.
Question 8
About how many football fields away is the target?
A number pad appears so the user can type the answer.
The UFO Translator converts this number into meters and uses it as the distance to the target.
Question 8
The UFO Translator generates an Immediate Suppression mission and tells the user to turn his/her radio to the Conduct of Fire net and say the following:
"_____ (FDC's callsign) this is _____ (user's callsign), Immediate Suppression, Polar, Direction _____, Distance _____, over."
"Please make sure the FDC reads this back to you correctly."
Question 9
What is the target?
A dropdown menu appears with the following choices:
Personnel
Armored Vehicle(s)
Non-armored Vehicle(s)
Aircraft on the ground
Fuel Site
Assembly Area
Other
If 'Other' is chosen, a keyboard will appear so the user can type the target description.
Question 9
Please wait for the FDC to say "Shot, over" and then immediately say "Shot, out."
Please wait for the FDC to say "Rounds Complete, over" and then immediately say "Rounds Complete, out."
This concludes the immediate suppression mission. If the desired results were not achieved:
1. Send a direction to the FDC.
2. Make a correction to the rounds using the criteria below.
3. Say "repeat, over."
Question 10
How many are there?
A number pad appears so the user can type in the number.
Question 10
Immediate Suppression Missions are self-ending; no Battle Damage Assessment is necessary.
This concludes the Immediate Suppression Mission.
Question 11
What is the target's degree of protection?
A dropdown menu appears.
In the open
In trenches
Overhead cover
In building(s)
Other
A keyboard will appear if the user chooses "other."
Question 11
What type of mission would you like to do?
A drop down menu appears with the following choices:
Adjust Fire
Fire for Effect (Default)
Question 12
Adjust Fire
Fire for Effect

The UFO Translator generates an Adjust Fire mission and tells the user to turn his/her radio to the Conduct of Fire net and say the following:

"_____ (FDC's callsign) this is _____ (user's callsign), Adjust Fire, Polar, over."

Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.

"Direction _____, Distance _____, over"

Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.

"_____(target description) _____ (degree of protection), _____ (method of engagement – if any), over."

Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.

Question 13

Please wait for the FDC to send you a Message to Observer. You must write down the Message to Observer and read it back to them.

After you read back the Message to Observer, before saying "out," say "break," release the handset for a moment, and then give the FDC the direction to the target.

If you do not copy down the entire message on the first try, ask the FDC to "Say Again, Over."

NEVER say "Repeat" on the radio!

Question 14

After you have read back the Message to Observer, please wait for the FDC to say "Shot, over," then immediately say:

"Shot, out."

Question 15

Did the round land over or short of the target?

A drop down menu appears.

Over
Short
Range Correct

Question 16

The UFO Translator generates a Fire for Effect mission and tells the user to turn his/her radio to the Conduct of Fire net and say the following:

"_____ (FDC's callsign) this is _____ (user's callsign), Fire for Effect, Polar, over."

Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.

"Direction _____, Distance _____, over"

Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.

"_____(target description) _____ (degree of protection), over."

Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.

Question 13

Please wait for the FDC to send you a Message to Observer. You must write down the Message to Observer and read it back to them.

If you do not copy down the entire message on the first try, ask the FDC to "Say Again, Over."

NEVER say "Repeat" on the radio!

Question 14

After you have read back the Message to Observer, please wait for the FDC to say "Shot, over," then immediately say:

"Shot, out."

After the FDC says, "Rounds Complete, over," say:

"Rounds Complete, out."

Question 15

If the rounds had the desired effect, begin the Battle Damage Assessment.

If the rounds did not have the desired effect, perform the following steps:

1. Send to the FDC a direction to the target.
2. Say, "Adjust Fire."
3. Give a correction and adjust the rounds onto the target.

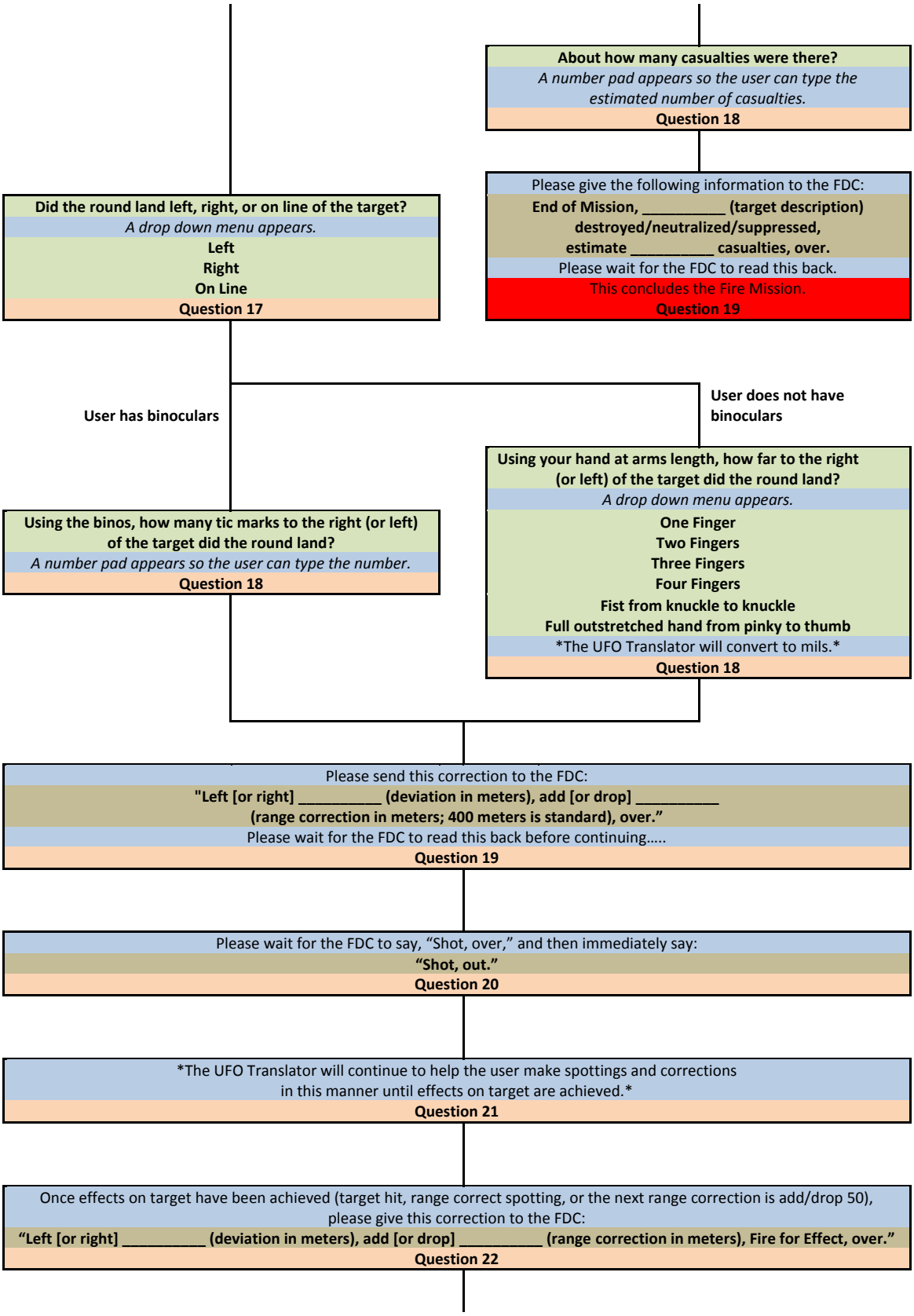
Question 16

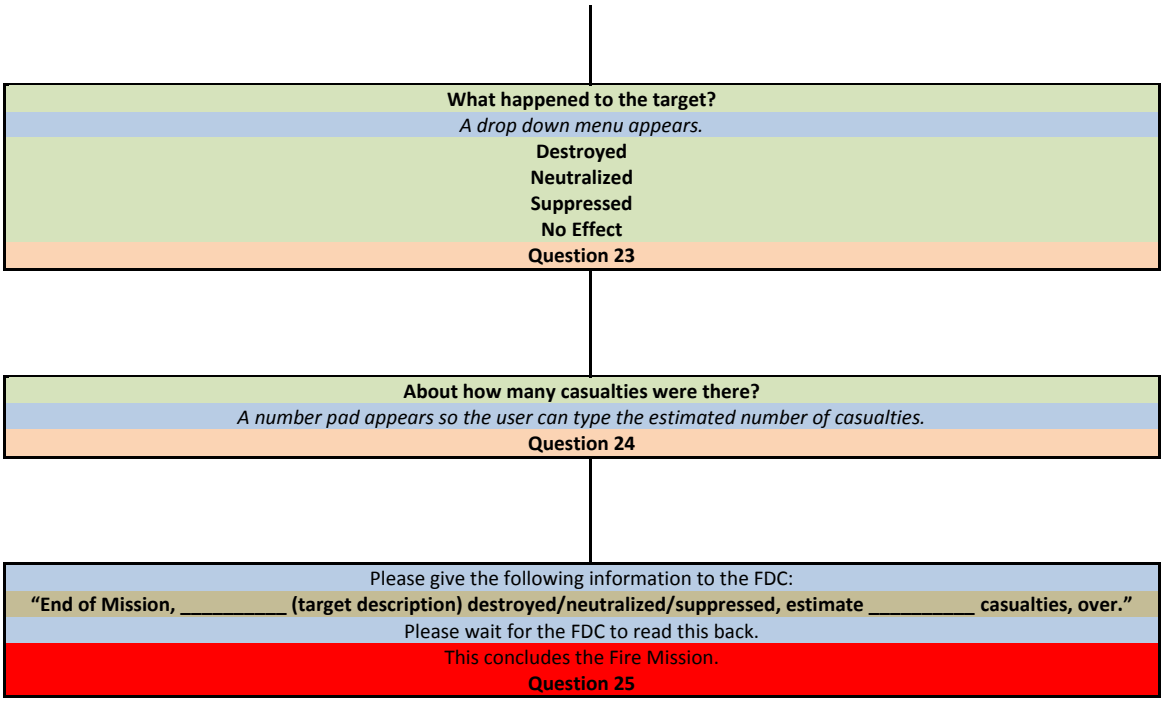
What happened to the target?

A drop down menu appears.

Destroyed
Neutralized
Suppressed
No Effect

Question 17


About how many casualties were there?
A number pad appears so the user can type the estimated number of casualties.
Question 18
Please give the following information to the FDC:
End of Mission, _____ (target description) destroyed/neutralized/suppressed, estimate _____ casualties, over.
Please wait for the FDC to read this back.
This concludes the Fire Mission.
Question 19
Did the round land left, right, or on line of the target?
A drop down menu appears.
Left
Right
On Line
Question 17
User has binoculars
User does not have binoculars
Using your hand at arms length, how far to the right (or left) of the target did the round land?
A drop down menu appears.
One Finger
Two Fingers
Three Fingers
Four Fingers
Fist from knuckle to knuckle
Full outstretched hand from pinky to thumb
The UFO Translator will convert to mils.
Question 18
Using the binos, how many tic marks to the right (or left) of the target did the round land?
A number pad appears so the user can type the number.
Question 18
Please send this correction to the FDC:
"Left [or right] _____ (deviation in meters), add [or drop] _____ (range correction in meters; 400 meters is standard), over."
Please wait for the FDC to read this back before continuing.....
Question 19
Please wait for the FDC to say, "Shot, over," and then immediately say:
"Shot, out."
Question 20
The UFO Translator will continue to help the user make spottings and corrections in this manner until effects on target are achieved.
Question 21
Once effects on target have been achieved (target hit, range correct spotting, or the next range correction is add/drop 50), please give this correction to the FDC:
"Left [or right] _____ (deviation in meters), add [or drop] _____ (range correction in meters), Fire for Effect, over."
Question 22


What happened to the target?
A drop down menu appears.
Destroyed
Neutralized
Suppressed
No Effect
Question 23
About how many casualties were there?
A number pad appears so the user can type the estimated number of casualties.
Question 24
Please give the following information to the FDC:
"End of Mission, _____ (target description) destroyed/neutralized/suppressed, estimate _____ casualties, over."
Please wait for the FDC to read this back.
This concludes the Fire Mission.
Question 25

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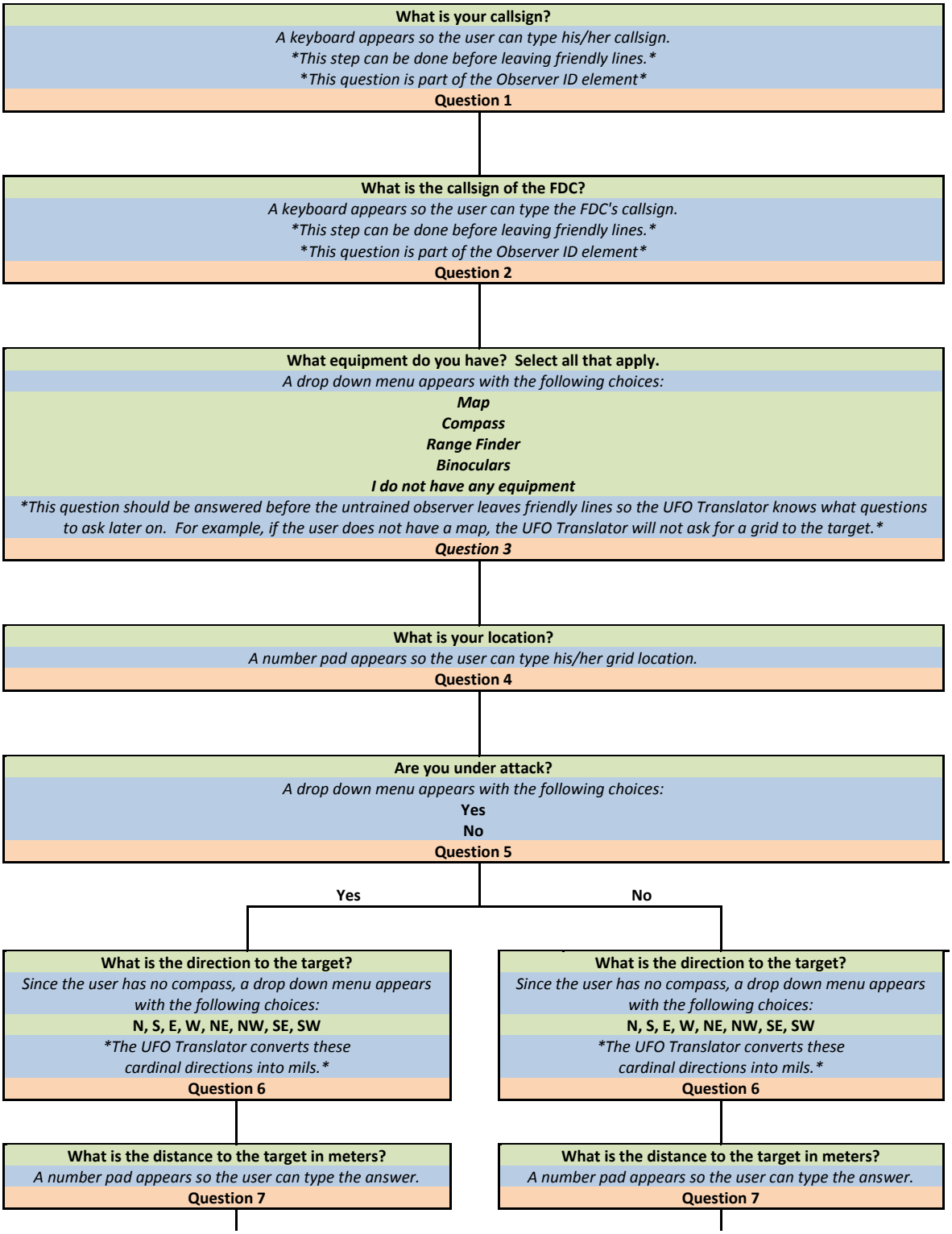
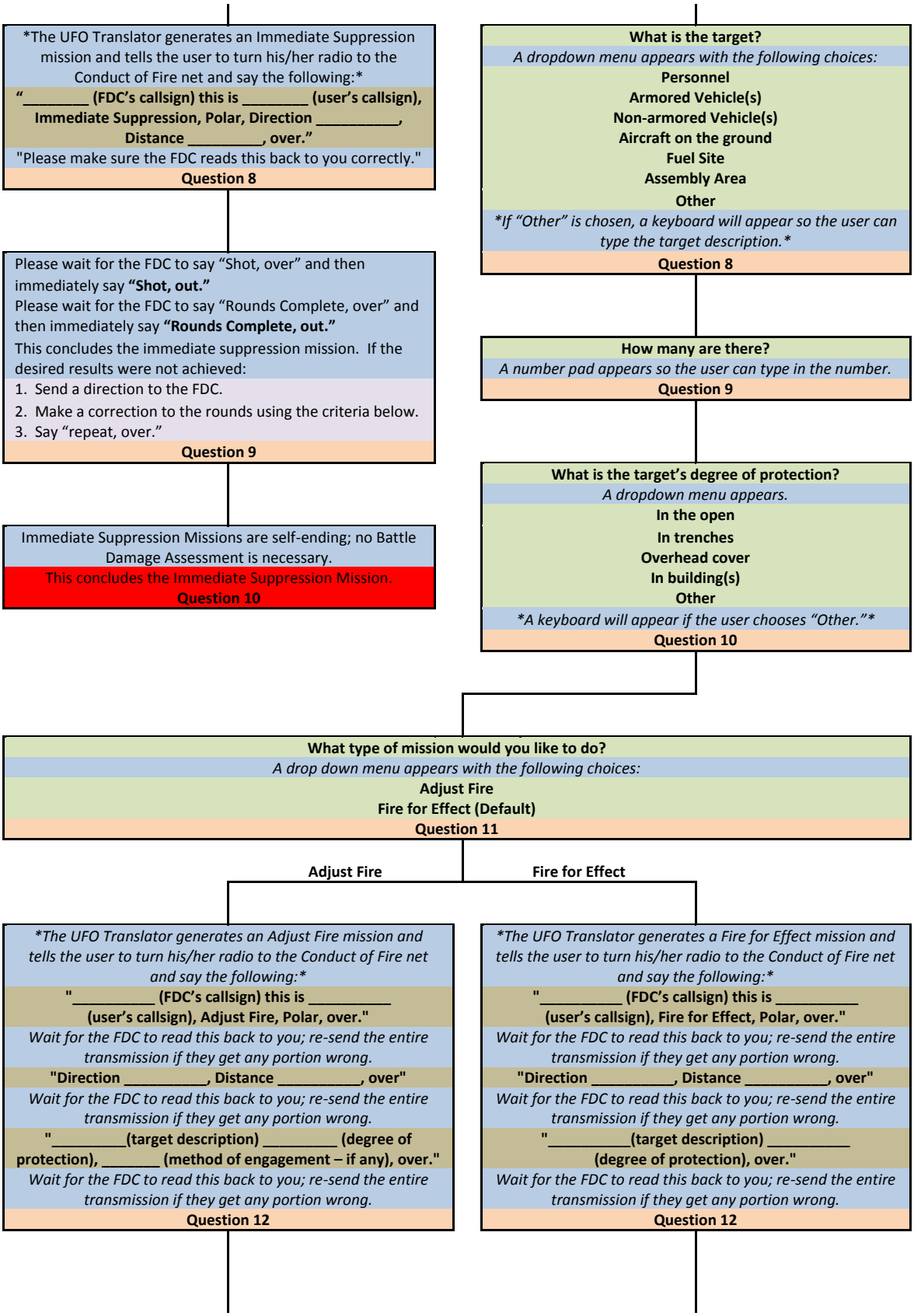
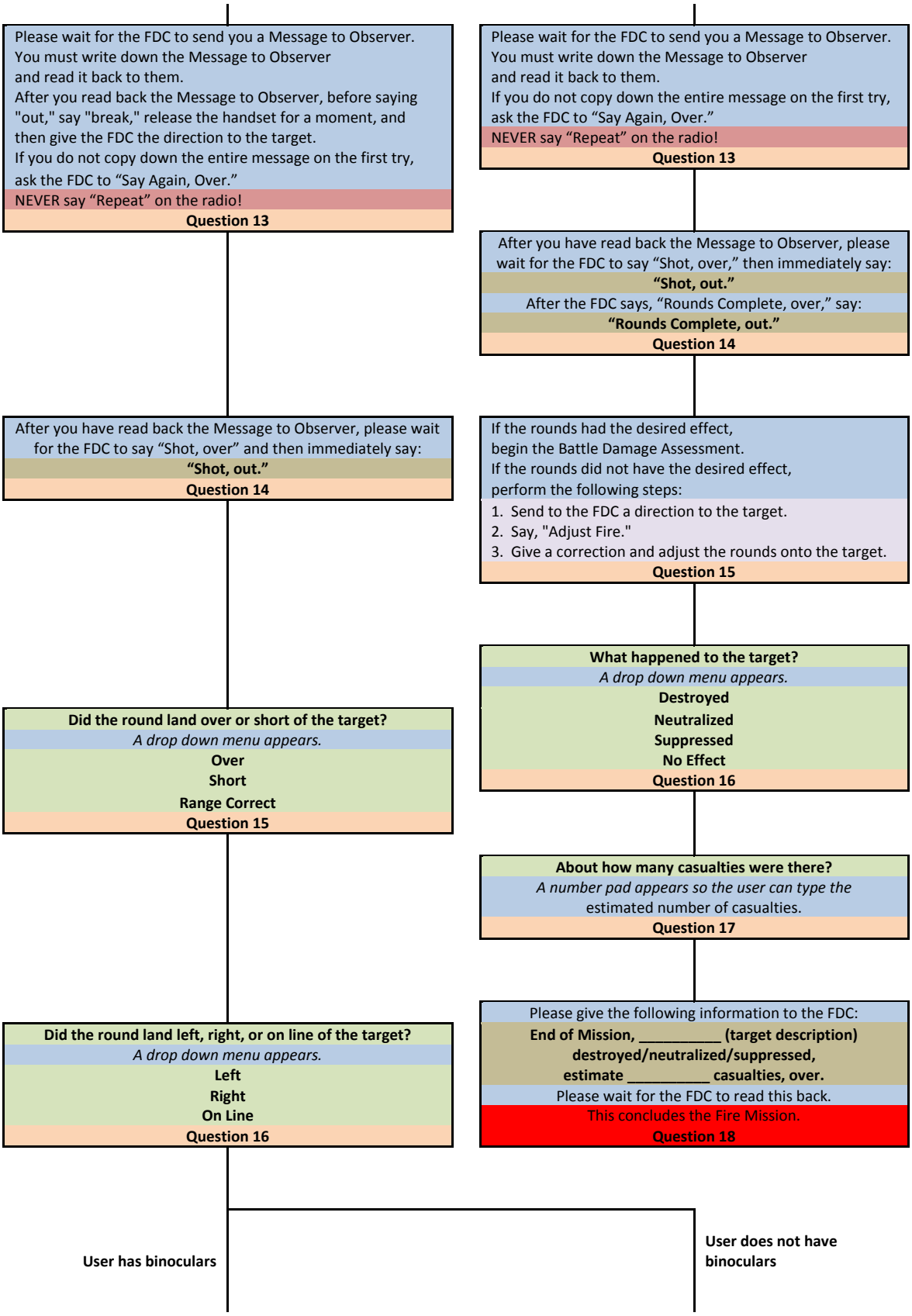
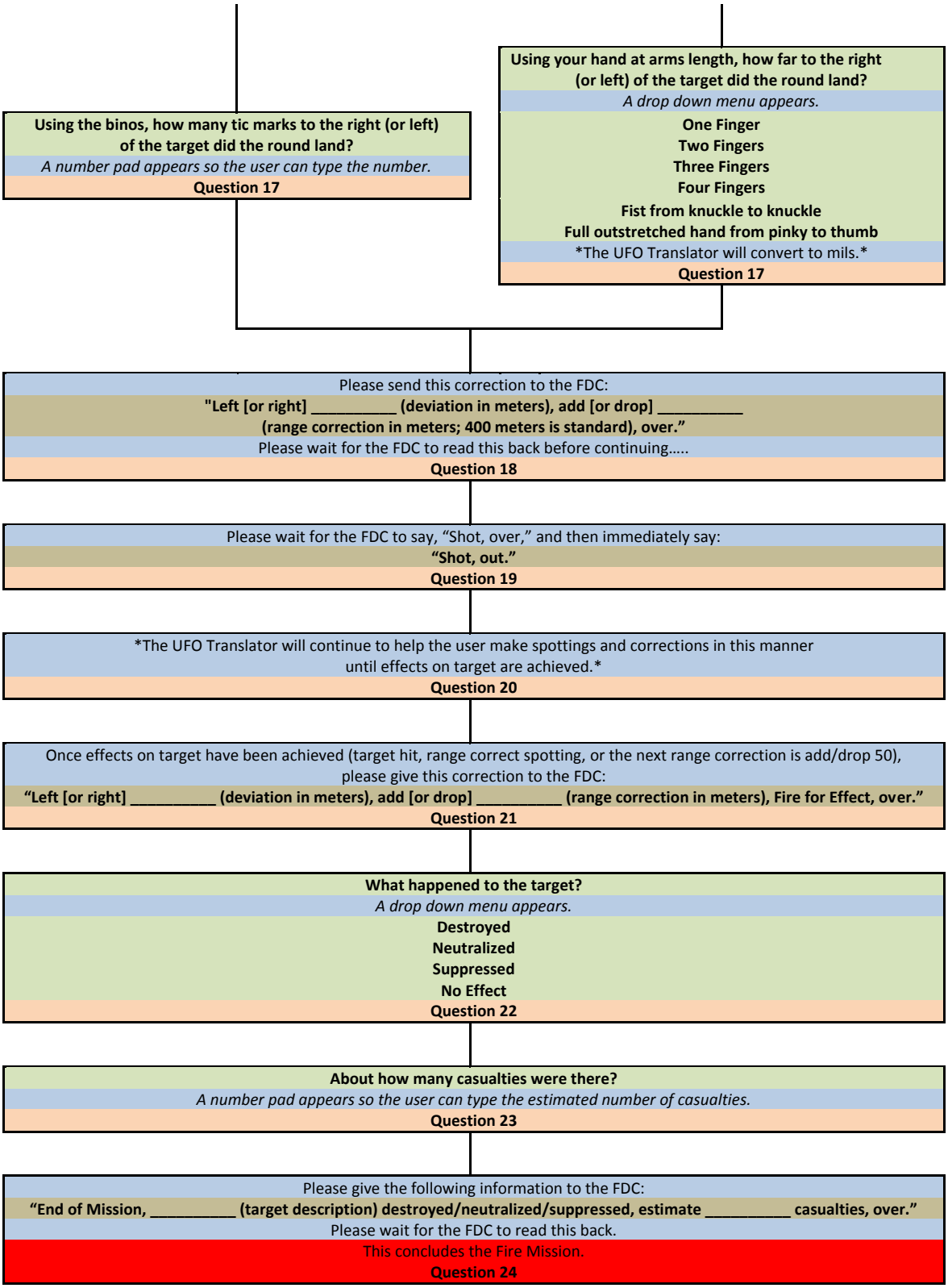
APPENDIX D. LOGIC TREE—USER HAS A RANGE FINDER ONLY

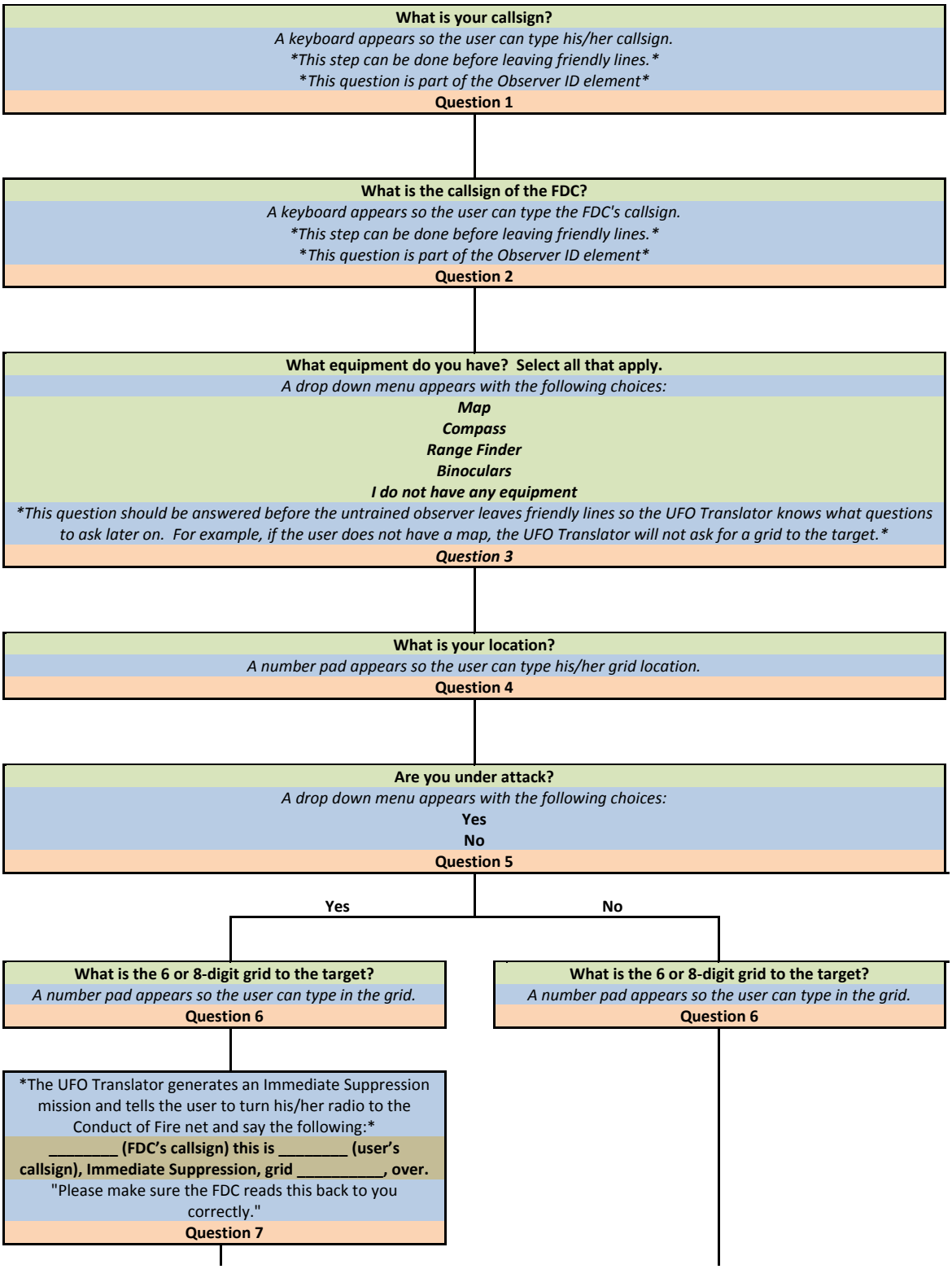


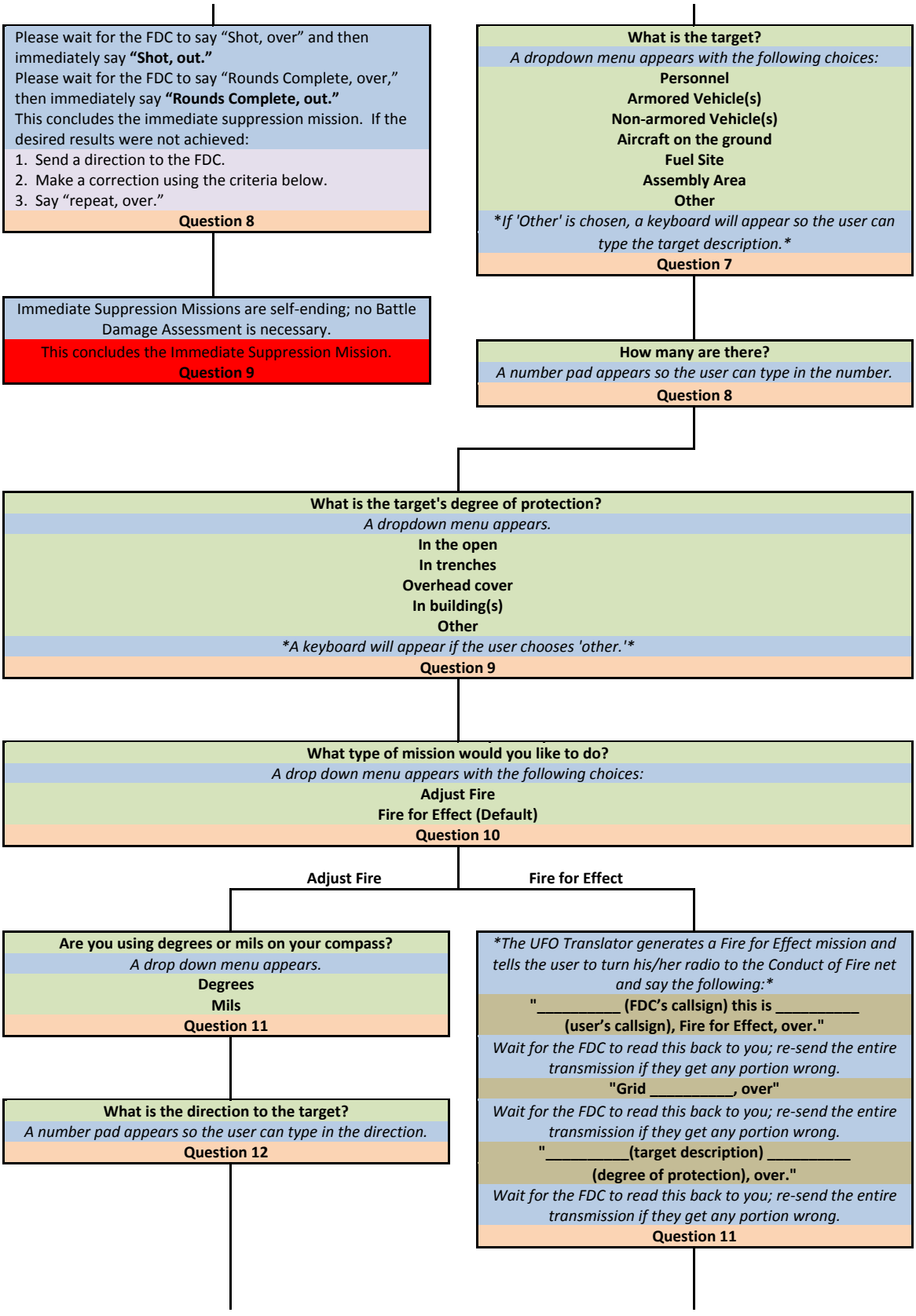

The UFO Translator generates an Immediate Suppression mission and tells the user to turn his/her radio to the Conduct of Fire net and say the following:
"_____ (FDC's callsign) this is _____ (user's callsign), Immediate Suppression, Polar, Direction _____, Distance _____, over."
"Please make sure the FDC reads this back to you correctly."
Question 8
Please wait for the FDC to say "Shot, over" and then immediately say "Shot, out."
Please wait for the FDC to say "Rounds Complete, over" and then immediately say "Rounds Complete, out."
This concludes the immediate suppression mission. If the desired results were not achieved:
1. Send a direction to the FDC.
2. Make a correction to the rounds using the criteria below.
3. Say "repeat, over."
Question 9
Immediate Suppression Missions are self-ending; no Battle Damage Assessment is necessary.
This concludes the Immediate Suppression Mission.
Question 10
What is the target?
A dropdown menu appears with the following choices:
Personnel
Armored Vehicle(s)
Non-armored Vehicle(s)
Aircraft on the ground
Fuel Site
Assembly Area
Other
If "Other" is chosen, a keyboard will appear so the user can type the target description.
Question 8
How many are there?
A number pad appears so the user can type in the number.
Question 9
What is the target's degree of protection?
A dropdown menu appears.
In the open
In trenches
Overhead cover
In building(s)
Other
A keyboard will appear if the user chooses "Other."
Question 10
What type of mission would you like to do?
A drop down menu appears with the following choices:
Adjust Fire
Fire for Effect (Default)
Question 11
Adjust Fire
Fire for Effect
The UFO Translator generates an Adjust Fire mission and tells the user to turn his/her radio to the Conduct of Fire net and say the following:
"_____ (FDC's callsign) this is _____ (user's callsign), Adjust Fire, Polar, over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"Direction _____, Distance _____, over"
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"_____(target description) _____ (degree of protection), _____ (method of engagement – if any), over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
Question 12
The UFO Translator generates a Fire for Effect mission and tells the user to turn his/her radio to the Conduct of Fire net and say the following:
"_____ (FDC's callsign) this is _____ (user's callsign), Fire for Effect, Polar, over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"Direction _____, Distance _____, over"
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"_____(target description) _____ (degree of protection), over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
Question 12

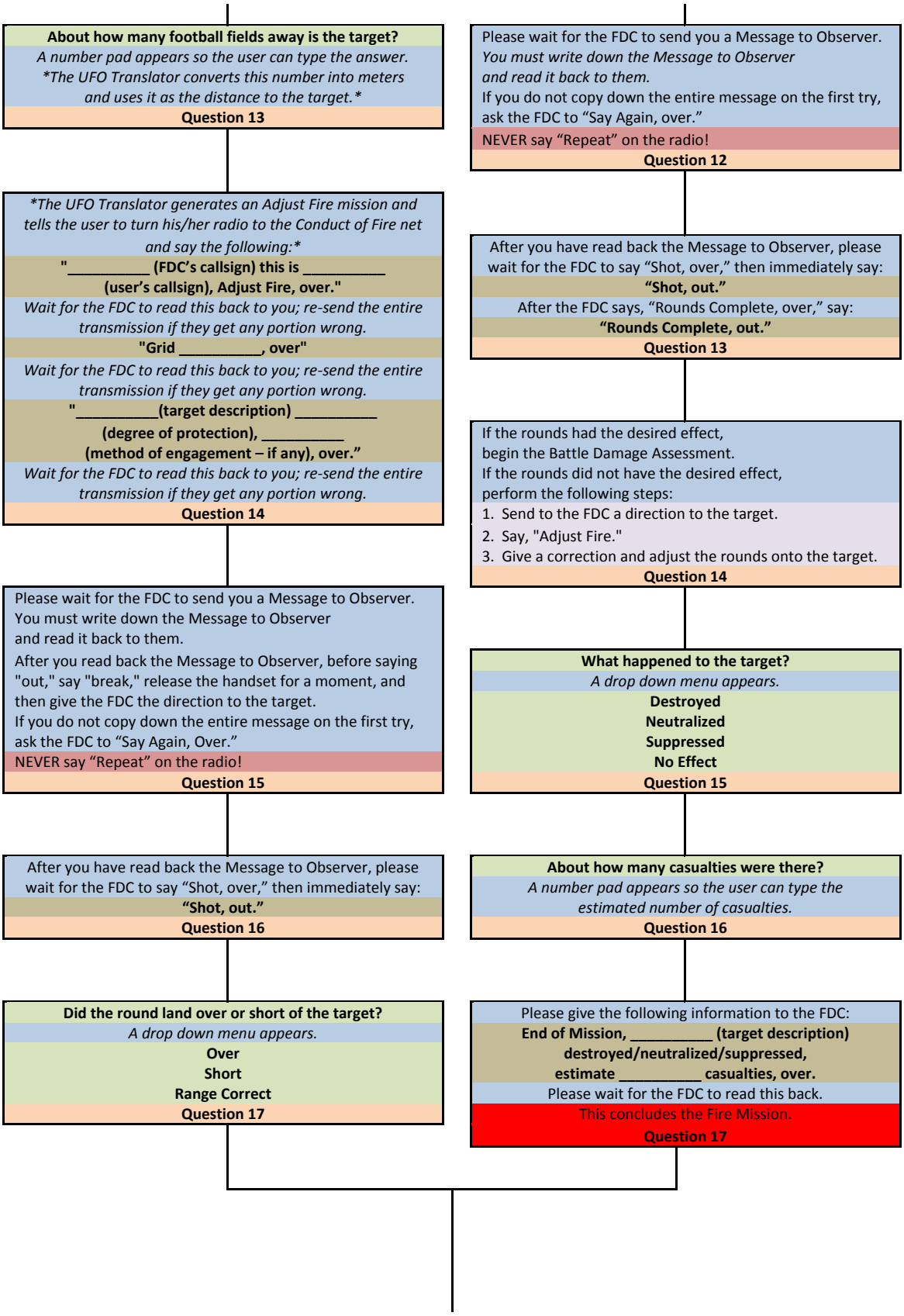

Please wait for the FDC to send you a Message to Observer.
You must write down the Message to Observer
and read it back to them.
After you read back the Message to Observer, before saying "out," say "break," release the handset for a moment, and then give the FDC the direction to the target.
If you do not copy down the entire message on the first try, ask the FDC to "Say Again, Over."
NEVER say "Repeat" on the radio!
Question 13
Please wait for the FDC to send you a Message to Observer.
You must write down the Message to Observer
and read it back to them.
If you do not copy down the entire message on the first try, ask the FDC to "Say Again, Over."
NEVER say "Repeat" on the radio!
Question 13
After you have read back the Message to Observer, please wait for the FDC to say "Shot, over," then immediately say:
"Shot, out."
After the FDC says, "Rounds Complete, over," say:
"Rounds Complete, out."
Question 14
After you have read back the Message to Observer, please wait for the FDC to say "Shot, over" and then immediately say:
"Shot, out."
Question 14
If the rounds had the desired effect, begin the Battle Damage Assessment.
If the rounds did not have the desired effect, perform the following steps:
1. Send to the FDC a direction to the target.
2. Say, "Adjust Fire."
3. Give a correction and adjust the rounds onto the target.
Question 15
What happened to the target?
A drop down menu appears.
Destroyed
Neutralized
Suppressed
No Effect
Question 16
Did the round land over or short of the target?
A drop down menu appears.
Over
Short
Range Correct
Question 15
About how many casualties were there?
A number pad appears so the user can type the estimated number of casualties.
Question 17
Did the round land left, right, or on line of the target?
A drop down menu appears.
Left
Right
On Line
Question 16
Please give the following information to the FDC:
End of Mission, _____ (target description) destroyed/neutralized/suppressed, estimate _____ casualties, over.
Please wait for the FDC to read this back.
This concludes the Fire Mission.
Question 18
User has binoculars
User does not have binoculars

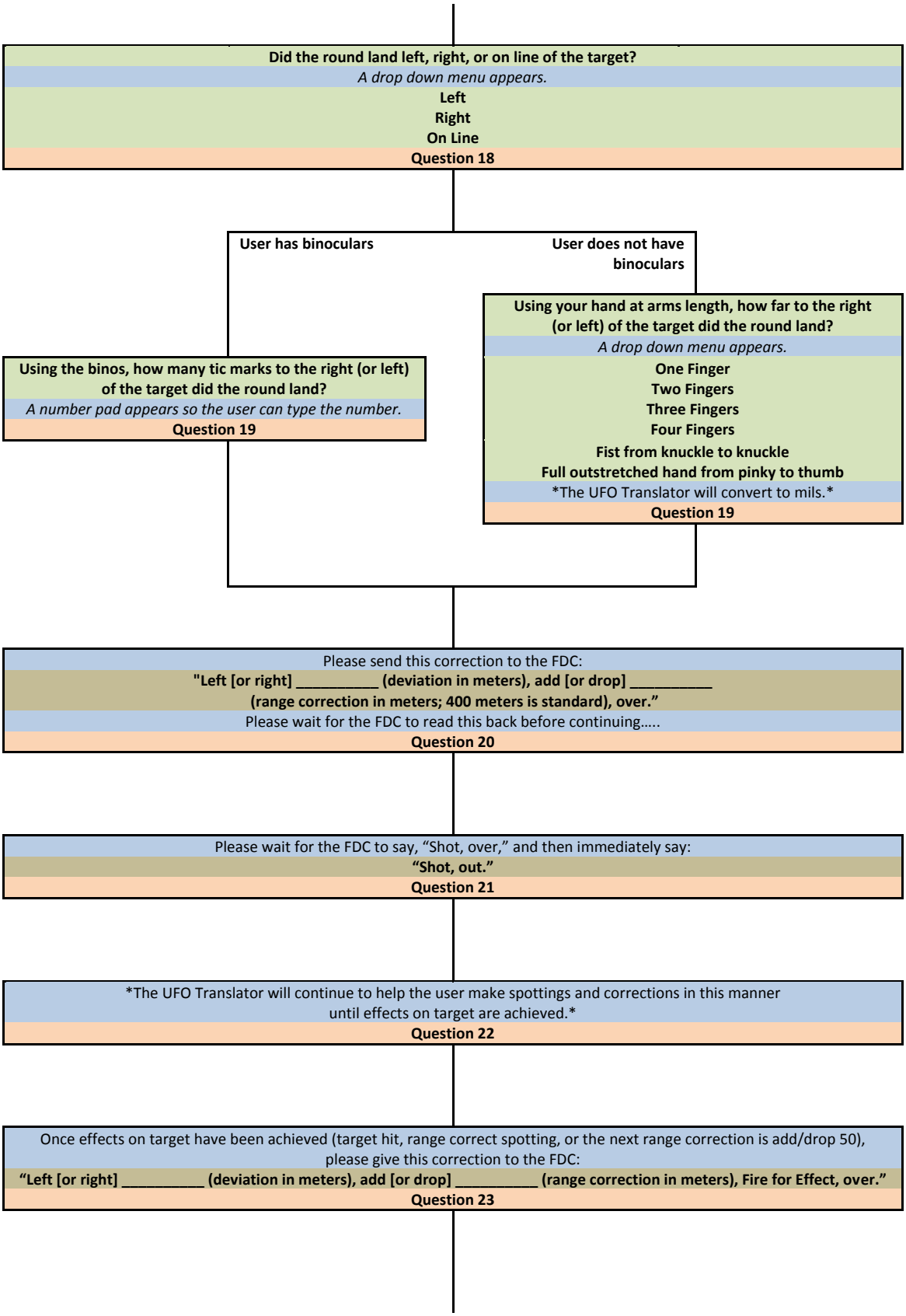

Using your hand at arms length, how far to the right (or left) of the target did the round land?
A drop down menu appears.
One Finger
Two Fingers
Three Fingers
Four Fingers
Fist from knuckle to knuckle
Full outstretched hand from pinky to thumb
The UFO Translator will convert to mils.
Question 17
Using the binos, how many tic marks to the right (or left) of the target did the round land?
A number pad appears so the user can type the number.
Question 17
Please send this correction to the FDC:
"Left [or right] _____ (deviation in meters), add [or drop] _____ (range correction in meters; 400 meters is standard), over."
Please wait for the FDC to read this back before continuing.....
Question 18
Please wait for the FDC to say, "Shot, over," and then immediately say:
"Shot, out."
Question 19
The UFO Translator will continue to help the user make spottings and corrections in this manner until effects on target are achieved.
Question 20
Once effects on target have been achieved (target hit, range correct spotting, or the next range correction is add/drop 50), please give this correction to the FDC:
"Left [or right] _____ (deviation in meters), add [or drop] _____ (range correction in meters), Fire for Effect, over."
Question 21
What happened to the target?
A drop down menu appears.
Destroyed
Neutralized
Suppressed
No Effect
Question 22
About how many casualties were there?
A number pad appears so the user can type the estimated number of casualties.
Question 23
Please give the following information to the FDC:
"End of Mission, _____ (target description) destroyed/neutralized/suppressed, estimate _____ casualties, over."
Please wait for the FDC to read this back.
This concludes the Fire Mission.
Question 24

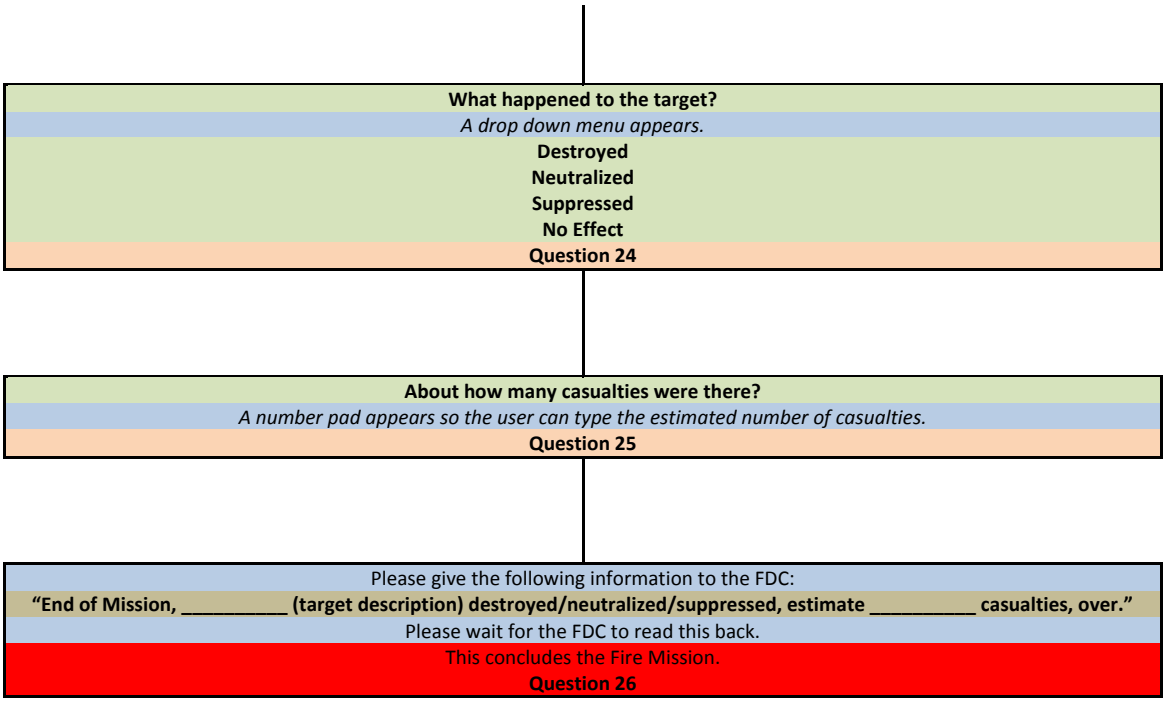
APPENDIX E. LOGIC TREE—USER HAS A MAP & COMPASS




Please wait for the FDC to say "Shot, over" and then immediately say **"Shot, out."**
Please wait for the FDC to say "Rounds Complete, over," then immediately say **"Rounds Complete, out."**
This concludes the immediate suppression mission. If the desired results were not achieved:
1. Send a direction to the FDC.
2. Make a correction using the criteria below.
3. Say "repeat, over."
Question 8
Immediate Suppression Missions are self-ending; no Battle Damage Assessment is necessary.
This concludes the Immediate Suppression Mission.
Question 9
What is the target?
A dropdown menu appears with the following choices:
Personnel
Armored Vehicle(s)
Non-armored Vehicle(s)
Aircraft on the ground
Fuel Site
Assembly Area
Other
If 'Other' is chosen, a keyboard will appear so the user can type the target description.
Question 7
How many are there?
A number pad appears so the user can type in the number.
Question 8
What is the target's degree of protection?
A dropdown menu appears.
In the open
In trenches
Overhead cover
In building(s)
Other
A keyboard will appear if the user chooses 'other.'
Question 9
What type of mission would you like to do?
A drop down menu appears with the following choices:
Adjust Fire
Fire for Effect (Default)
Question 10
Adjust Fire
Fire for Effect
Are you using degrees or mils on your compass?
A drop down menu appears.
Degrees
Mils
Question 11
What is the direction to the target?
A number pad appears so the user can type in the direction.
Question 12
The UFO Translator generates a Fire for Effect mission and tells the user to turn his/her radio to the Conduct of Fire net and say the following:
"_____ (FDC's callsign) this is _____ (user's callsign), Fire for Effect, over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"Grid _____, over"
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"_____(target description) _____ (degree of protection), over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
Question 11


About how many football fields away is the target?
A number pad appears so the user can type the answer.
The UFO Translator converts this number into meters and uses it as the distance to the target.
Question 13
The UFO Translator generates an Adjust Fire mission and tells the user to turn his/her radio to the Conduct of Fire net and say the following:
"_____ (FDC's callsign) this is _____ (user's callsign), Adjust Fire, over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"Grid _____, over"
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"_____(target description) _____ (degree of protection), _____ (method of engagement – if any), over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
Question 14
Please wait for the FDC to send you a Message to Observer.
You must write down the Message to Observer and read it back to them.
After you read back the Message to Observer, before saying "out," say "break," release the handset for a moment, and then give the FDC the direction to the target.
If you do not copy down the entire message on the first try, ask the FDC to "Say Again, Over."
NEVER say "Repeat" on the radio!
Question 15
After you have read back the Message to Observer, please wait for the FDC to say "Shot, over," then immediately say:
"Shot, out."
Question 16
Did the round land over or short of the target?
A drop down menu appears.
Over
Short
Range Correct
Question 17
Please wait for the FDC to send you a Message to Observer.
You must write down the Message to Observer and read it back to them.
If you do not copy down the entire message on the first try, ask the FDC to "Say Again, over."
NEVER say "Repeat" on the radio!
Question 12
After you have read back the Message to Observer, please wait for the FDC to say "Shot, over," then immediately say:
"Shot, out."
After the FDC says, "Rounds Complete, over," say:
"Rounds Complete, out."
Question 13
If the rounds had the desired effect, begin the Battle Damage Assessment.
If the rounds did not have the desired effect, perform the following steps:
1. Send to the FDC a direction to the target.
2. Say, "Adjust Fire."
3. Give a correction and adjust the rounds onto the target.
Question 14
What happened to the target?
A drop down menu appears.
Destroyed
Neutralized
Suppressed
No Effect
Question 15
About how many casualties were there?
A number pad appears so the user can type the estimated number of casualties.
Question 16
Please give the following information to the FDC:
End of Mission, _____ (target description) destroyed/neutralized/suppressed, estimate _____ casualties, over.
Please wait for the FDC to read this back.
This concludes the Fire Mission.
Question 17


Did the round land left, right, or on line of the target?
A drop down menu appears.
Left
Right
On Line
Question 18
User has binoculars
User does not have binoculars
Using your hand at arms length, how far to the right (or left) of the target did the round land?
A drop down menu appears.
One Finger
Two Fingers
Three Fingers
Four Fingers
Fist from knuckle to knuckle
Full outstretched hand from pinky to thumb
The UFO Translator will convert to mils.
Question 19
Using the binos, how many tic marks to the right (or left) of the target did the round land?
A number pad appears so the user can type the number.
Question 19
Please send this correction to the FDC:
"Left [or right] _____ (deviation in meters), add [or drop] _____ (range correction in meters; 400 meters is standard), over."
Please wait for the FDC to read this back before continuing…..
Question 20
Please wait for the FDC to say, "Shot, over," and then immediately say:
"Shot, out."
Question 21
The UFO Translator will continue to help the user make spottings and corrections in this manner until effects on target are achieved.
Question 22
Once effects on target have been achieved (target hit, range correct spotting, or the next range correction is add/drop 50), please give this correction to the FDC:
"Left [or right] _____ (deviation in meters), add [or drop] _____ (range correction in meters), Fire for Effect, over."
Question 23


What happened to the target?
A drop down menu appears.
Destroyed
Neutralized
Suppressed
No Effect
Question 24
About how many casualties were there?
A number pad appears so the user can type the estimated number of casualties.
Question 25
Please give the following information to the FDC:
"End of Mission, _____ (target description) destroyed/neutralized/suppressed, estimate _____ casualties, over."
Please wait for the FDC to read this back.
This concludes the Fire Mission.
Question 26

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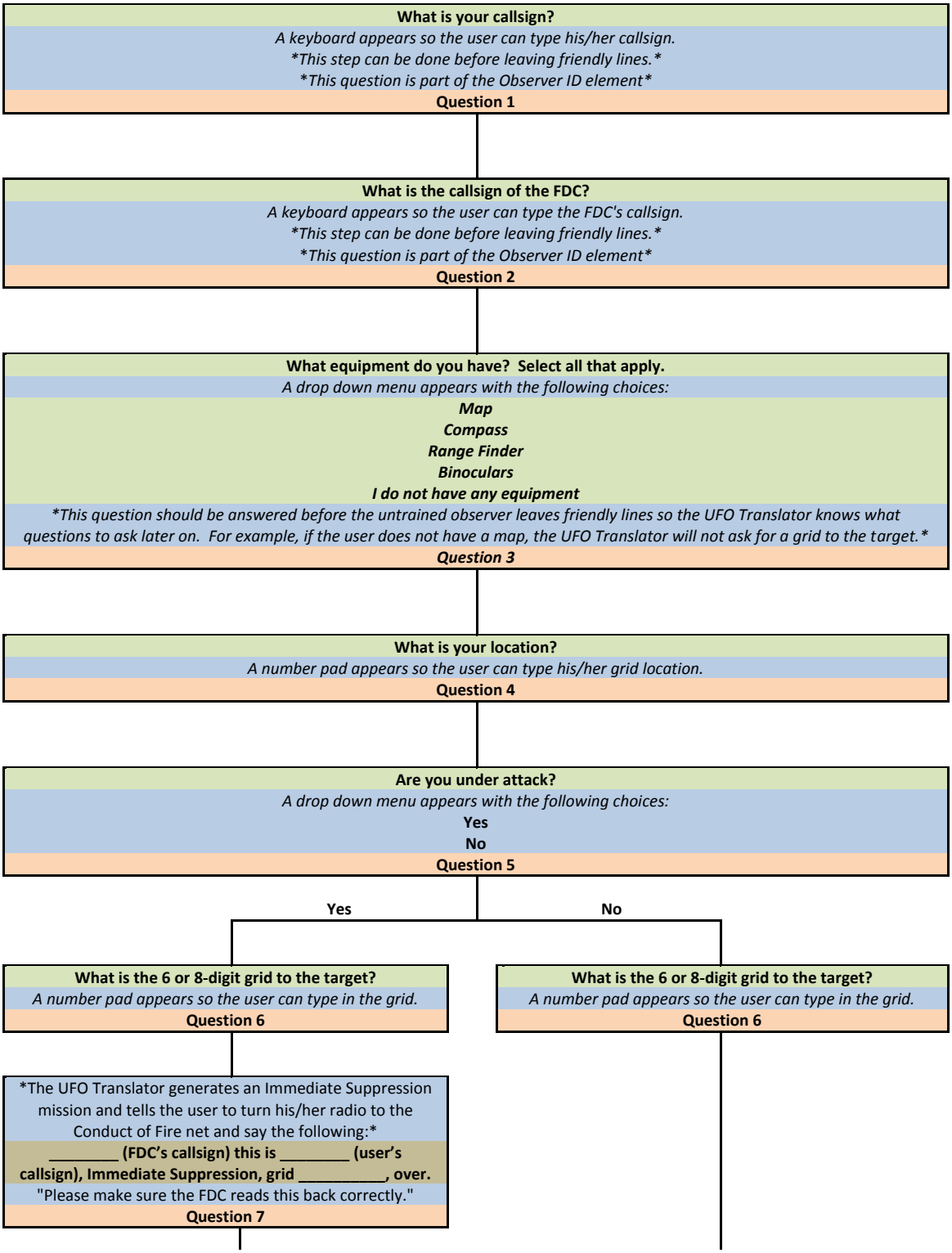
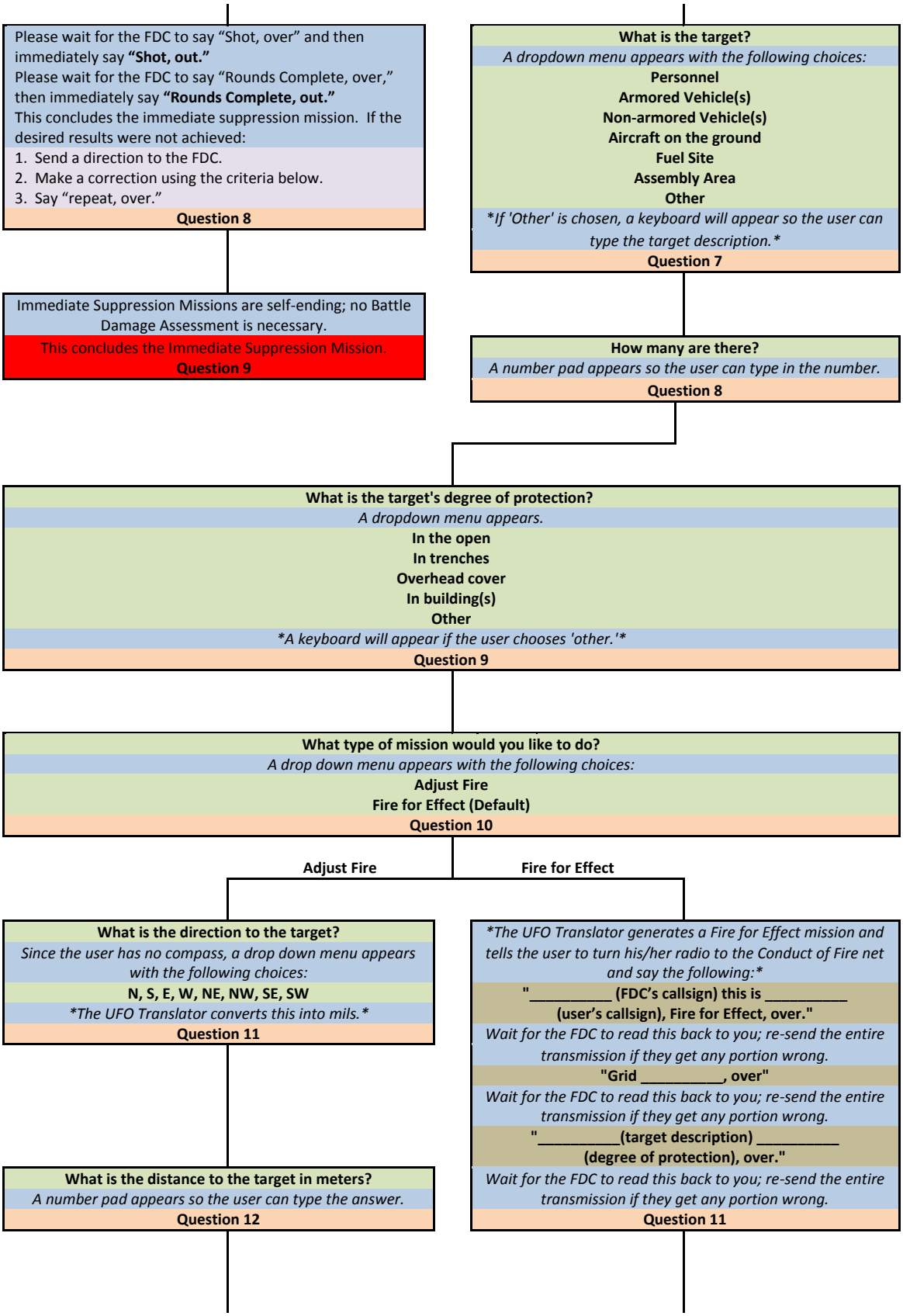
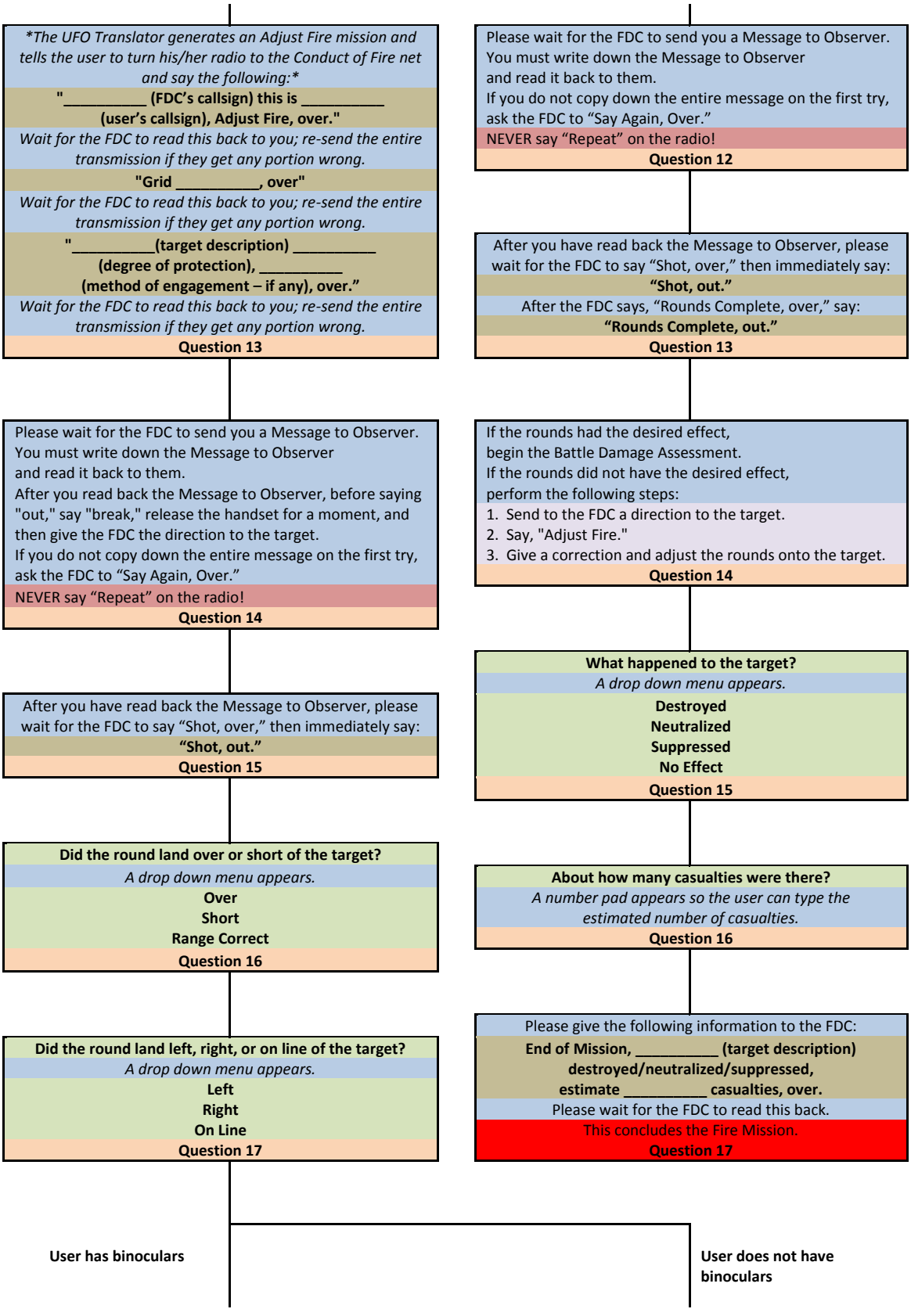
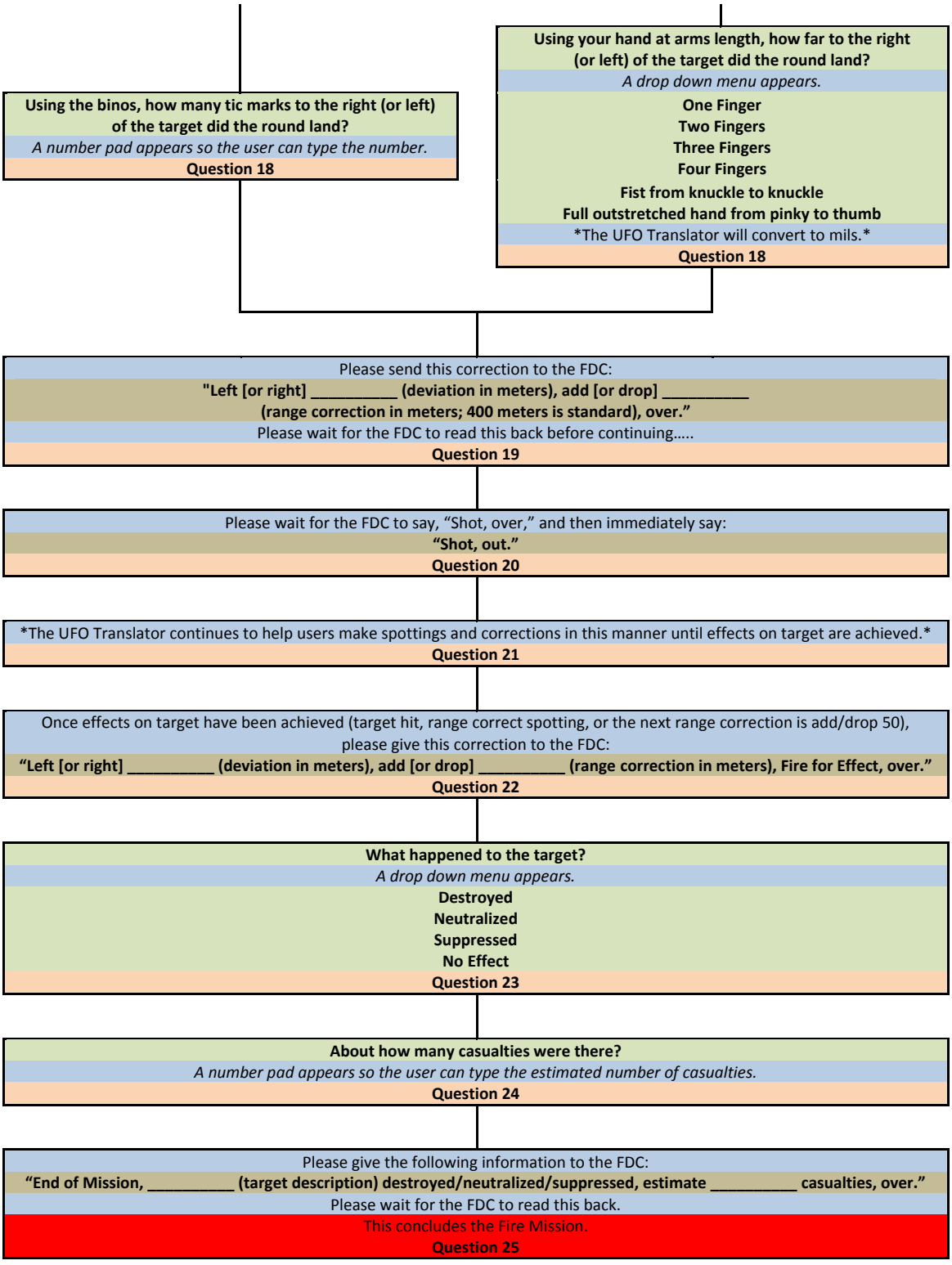
APPENDIX F. LOGIC TREE—USER HAS A MAP & RANGE FINDER

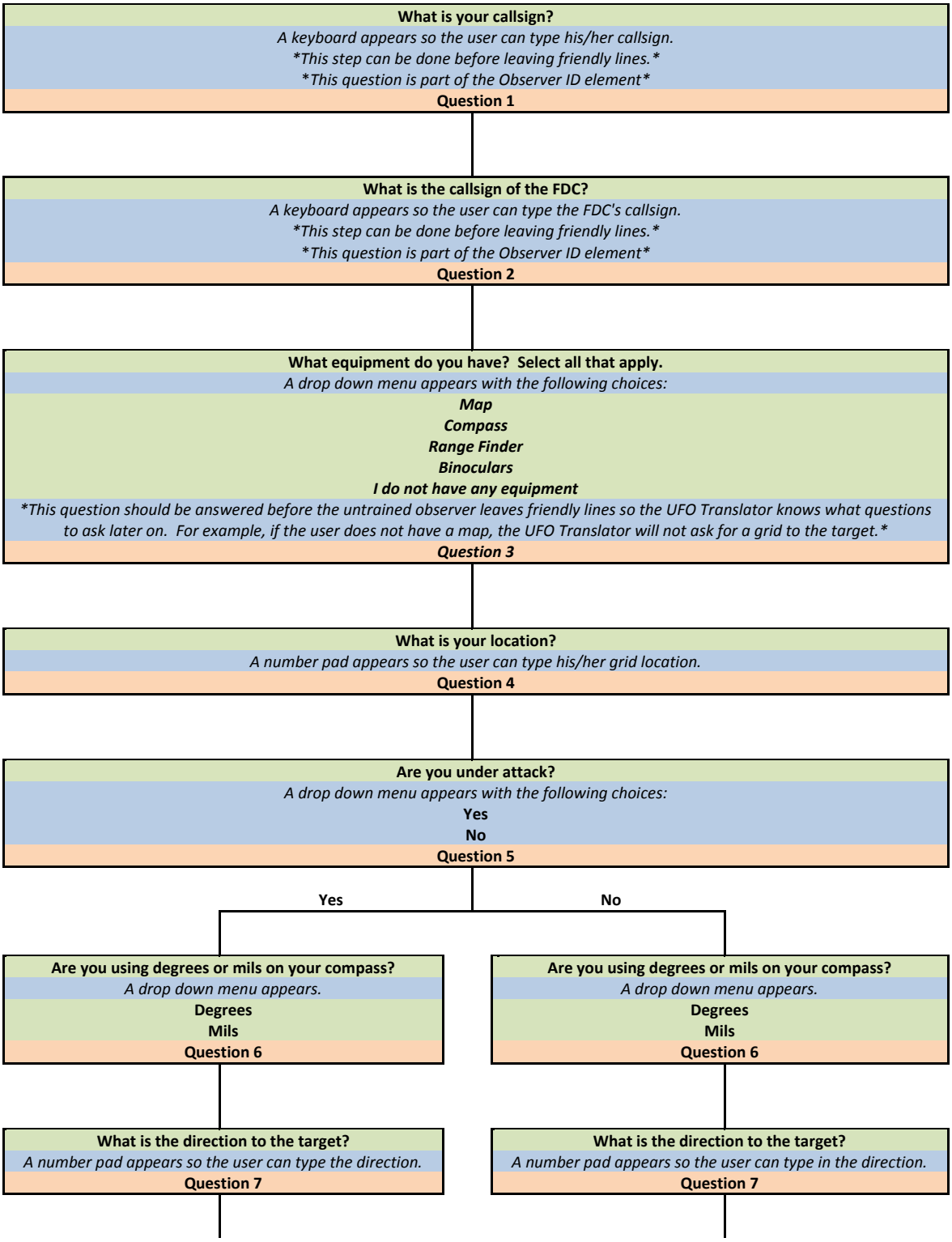


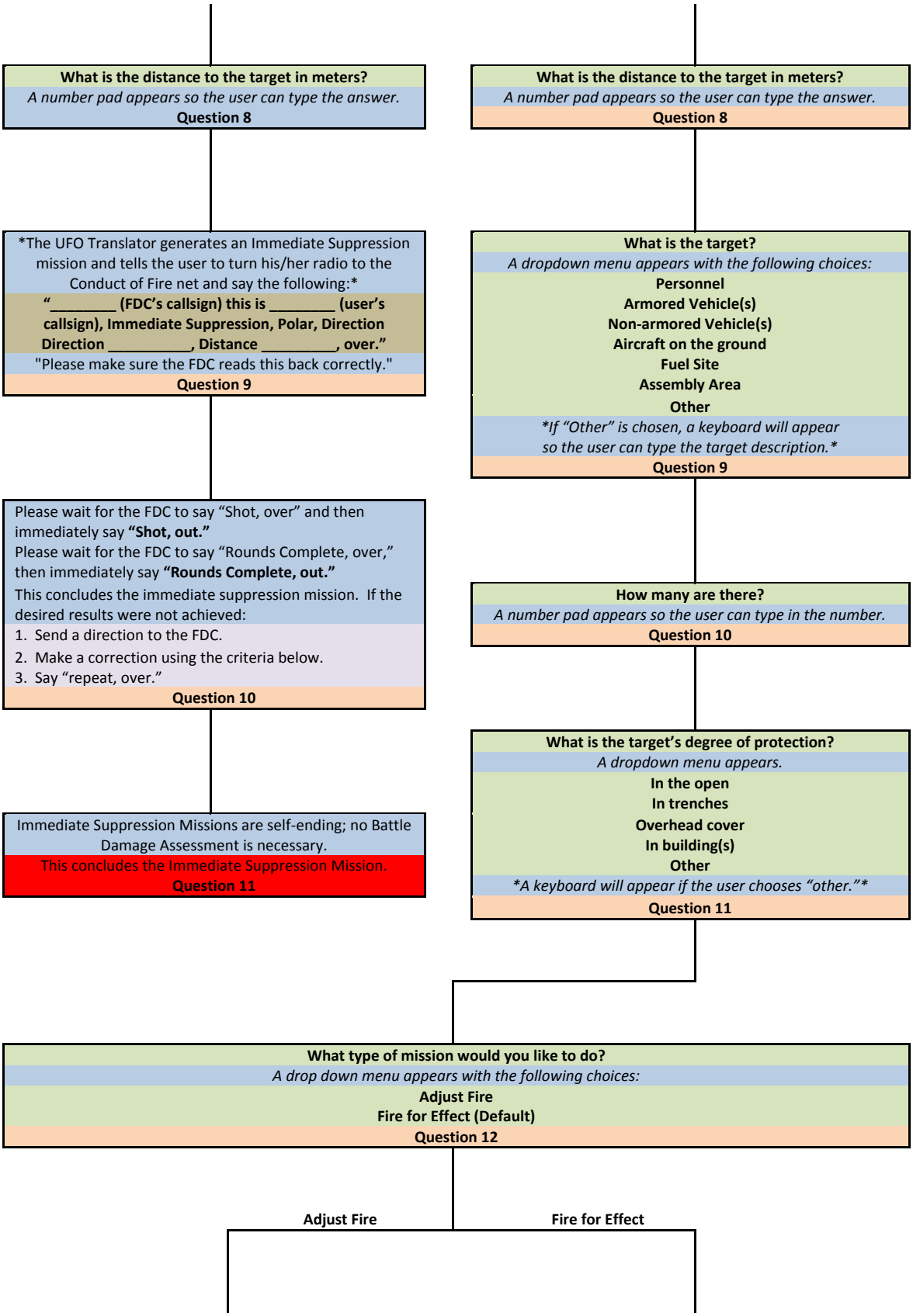

Please wait for the FDC to say "Shot, over" and then immediately say **"Shot, out."**
Please wait for the FDC to say "Rounds Complete, over," then immediately say **"Rounds Complete, out."**
This concludes the immediate suppression mission. If the desired results were not achieved:
1. Send a direction to the FDC.
2. Make a correction using the criteria below.
3. Say "repeat, over."
Question 8
Immediate Suppression Missions are self-ending; no Battle Damage Assessment is necessary.
This concludes the Immediate Suppression Mission.
Question 9
What is the target?
A dropdown menu appears with the following choices:
Personnel
Armored Vehicle(s)
Non-armored Vehicle(s)
Aircraft on the ground
Fuel Site
Assembly Area
Other
If 'Other' is chosen, a keyboard will appear so the user can type the target description.
Question 7
How many are there?
A number pad appears so the user can type in the number.
Question 8
What is the target's degree of protection?
A dropdown menu appears.
In the open
In trenches
Overhead cover
In building(s)
Other
A keyboard will appear if the user chooses 'other.'
Question 9
What type of mission would you like to do?
A drop down menu appears with the following choices:
Adjust Fire
Fire for Effect (Default)
Question 10
Adjust Fire
Fire for Effect
What is the direction to the target?
Since the user has no compass, a drop down menu appears with the following choices:
N, S, E, W, NE, NW, SE, SW
The UFO Translator converts this into mils.
Question 11
What is the distance to the target in meters?
A number pad appears so the user can type the answer.
Question 12
The UFO Translator generates a Fire for Effect mission and tells the user to turn his/her radio to the Conduct of Fire net and say the following:
"_____ (FDC's callsign) this is _____ (user's callsign), Fire for Effect, over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"Grid _____, over"
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"_____(target description) _____ (degree of protection), over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
Question 11


The UFO Translator generates an Adjust Fire mission and tells the user to turn his/her radio to the Conduct of Fire net and say the following:
"_____ (FDC's callsign) this is _____ (user's callsign), Adjust Fire, over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"Grid _____, over"
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"_____(target description) _____ (degree of protection), _____ (method of engagement – if any), over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
Question 13
Please wait for the FDC to send you a Message to Observer.
You must write down the Message to Observer and read it back to them.
After you read back the Message to Observer, before saying "out," say "break," release the handset for a moment, and then give the FDC the direction to the target.
If you do not copy down the entire message on the first try, ask the FDC to "Say Again, Over."
NEVER say "Repeat" on the radio!
Question 14
After you have read back the Message to Observer, please wait for the FDC to say "Shot, over," then immediately say:
"Shot, out."
Question 15
Did the round land over or short of the target?
A drop down menu appears.
Over
Short
Range Correct
Question 16
Did the round land left, right, or on line of the target?
A drop down menu appears.
Left
Right
On Line
Question 17
User has binoculars
Please wait for the FDC to send you a Message to Observer.
You must write down the Message to Observer and read it back to them.
If you do not copy down the entire message on the first try, ask the FDC to "Say Again, Over."
NEVER say "Repeat" on the radio!
Question 12
After you have read back the Message to Observer, please wait for the FDC to say "Shot, over," then immediately say:
"Shot, out."
After the FDC says, "Rounds Complete, over," say:
"Rounds Complete, out."
Question 13
If the rounds had the desired effect, begin the Battle Damage Assessment.
If the rounds did not have the desired effect, perform the following steps:
1. Send to the FDC a direction to the target.
2. Say, "Adjust Fire."
3. Give a correction and adjust the rounds onto the target.
Question 14
What happened to the target?
A drop down menu appears.
Destroyed
Neutralized
Suppressed
No Effect
Question 15
About how many casualties were there?
A number pad appears so the user can type the estimated number of casualties.
Question 16
Please give the following information to the FDC:
End of Mission, _____ (target description) destroyed/neutralized/suppressed, estimate _____ casualties, over.
Please wait for the FDC to read this back.
This concludes the Fire Mission.
Question 17
User does not have binoculars


Using your hand at arms length, how far to the right (or left) of the target did the round land?
A drop down menu appears.
One Finger
Two Fingers
Three Fingers
Four Fingers
Fist from knuckle to knuckle
Full outstretched hand from pinky to thumb
The UFO Translator will convert to mils.
Question 18
Using the binos, how many tic marks to the right (or left) of the target did the round land?
A number pad appears so the user can type the number.
Question 18
Please send this correction to the FDC:
"Left [or right] _____ (deviation in meters), add [or drop] _____ (range correction in meters; 400 meters is standard), over."
Please wait for the FDC to read this back before continuing…..
Question 19
Please wait for the FDC to say, "Shot, over," and then immediately say:
"Shot, out."
Question 20
The UFO Translator continues to help users make spottings and corrections in this manner until effects on target are achieved.
Question 21
Once effects on target have been achieved (target hit, range correct spotting, or the next range correction is add/drop 50), please give this correction to the FDC:
"Left [or right] _____ (deviation in meters), add [or drop] _____ (range correction in meters), Fire for Effect, over."
Question 22
What happened to the target?
A drop down menu appears.
Destroyed
Neutralized
Suppressed
No Effect
Question 23
About how many casualties were there?
A number pad appears so the user can type the estimated number of casualties.
Question 24
Please give the following information to the FDC:
"End of Mission, _____ (target description) destroyed/neutralized/suppressed, estimate _____ casualties, over."
Please wait for the FDC to read this back.
This concludes the Fire Mission.
Question 25

APPENDIX G. LOGIC TREE—USER HAS A COMPASS & RANGE FINDER




What is the distance to the target in meters?
A number pad appears so the user can type the answer.
Question 8
What is the distance to the target in meters?
A number pad appears so the user can type the answer.
Question 8
The UFO Translator generates an Immediate Suppression mission and tells the user to turn his/her radio to the Conduct of Fire net and say the following:
"_____ (FDC's callsign) this is _____ (user's callsign), Immediate Suppression, Polar, Direction Direction _____, Distance _____, over."
"Please make sure the FDC reads this back correctly."
Question 9
What is the target?
A dropdown menu appears with the following choices:
Personnel
Armored Vehicle(s)
Non-armored Vehicle(s)
Aircraft on the ground
Fuel Site
Assembly Area
Other
If "Other" is chosen, a keyboard will appear so the user can type the target description.
Question 9
Please wait for the FDC to say "Shot, over" and then immediately say "Shot, out."
Please wait for the FDC to say "Rounds Complete, over," then immediately say "Rounds Complete, out."
This concludes the immediate suppression mission. If the desired results were not achieved:
1. Send a direction to the FDC.
2. Make a correction using the criteria below.
3. Say "repeat, over."
Question 10
How many are there?
A number pad appears so the user can type in the number.
Question 10
What is the target's degree of protection?
A dropdown menu appears.
In the open
In trenches
Overhead cover
In building(s)
Other
A keyboard will appear if the user chooses "other."
Question 11
Immediate Suppression Missions are self-ending; no Battle Damage Assessment is necessary.
This concludes the Immediate Suppression Mission.
Question 11
What type of mission would you like to do?
A drop down menu appears with the following choices:
Adjust Fire
Fire for Effect (Default)
Question 12
Adjust Fire
Fire for Effect

The UFO Translator generates an Adjust Fire mission and tells the user to turn his/her radio to the Conduct of Fire net and say the following:

"_____ (FDC's callsign) this is _____ (user's callsign), Adjust Fire, Polar, over."

Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.

"Direction _____, Distance _____, over"

Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.

"_____(target description) _____ (degree of protection), _____ (method of engagement – if any), over."

Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.

Question 13

Please wait for the FDC to send you a Message to Observer.
You must write down the Message to Observer and read it back to them.
After you read back the Message to Observer, before saying "out," say "break," release the handset for a moment, and then give the FDC the direction to the target.
If you do not copy down the entire message on the first try, ask the FDC to "Say Again, Over."
NEVER say "Repeat" on the radio!

Question 14

After you have read back the Message to Observer, please wait for the FDC to say "Shot, over" and then immediately say:

"Shot, out."

Question 15

Did the round land over or short of the target?

A drop down menu appears.

Over
Short
Range Correct

Question 16

The UFO Translator generates a Fire for Effect mission and tells the user to turn his/her radio to the Conduct of Fire net and say the following:

"_____ (FDC's callsign) this is _____ (user's callsign), Fire for Effect, Polar, over."

Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.

"Direction _____, Distance _____, over"

Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.

"_____(target description) _____ (degree of protection), over."

Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.

Question 13

Please wait for the FDC to send you a Message to Observer.
You must write down the Message to Observer and read it back to them.
If you do not copy down the entire message on the first try, ask the FDC to "Say Again, Over."
NEVER say "Repeat" on the radio!

Question 14

After you have read back the Message to Observer, please wait for the FDC to say "Shot, over," then immediately say:

"Shot, out."

After the FDC says, "Rounds Complete, over," say:

"Rounds Complete, out."

Question 15

If the rounds had the desired effect, begin the Battle Damage Assessment.
If the rounds did not have the desired effect, perform the following steps:

1. Send to the FDC a direction to the target.
2. Say, "Adjust Fire."
3. Give a correction and adjust the rounds onto the target.

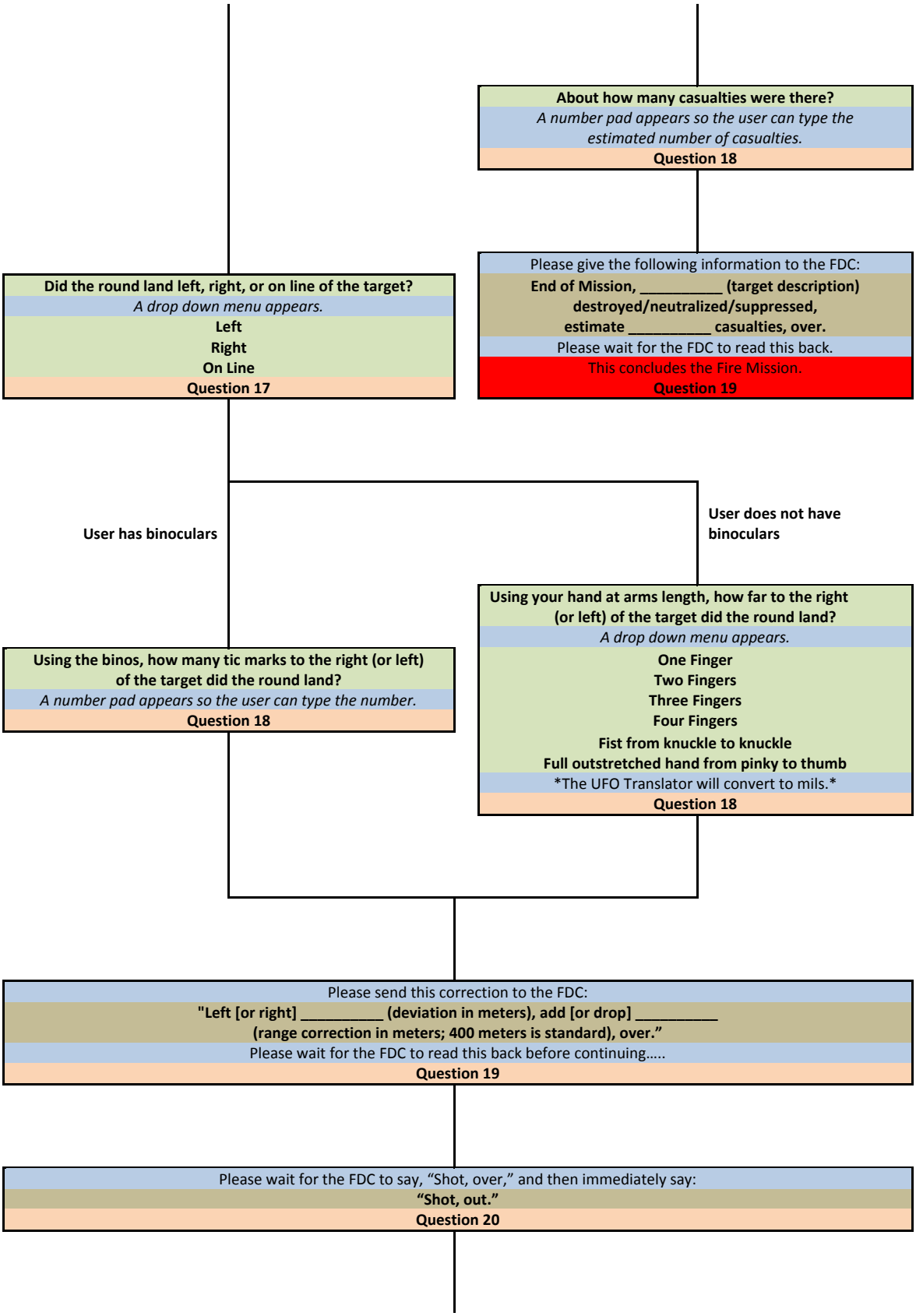
Question 16

What happened to the target?

A drop down menu appears.

Destroyed
Neutralized
Suppressed
No Effect

Question 17


About how many casualties were there?
A number pad appears so the user can type the estimated number of casualties.
Question 18
Please give the following information to the FDC:
End of Mission, _____ (target description) destroyed/neutralized/suppressed, estimate _____ casualties, over.
Please wait for the FDC to read this back.
This concludes the Fire Mission.
Question 19
Did the round land left, right, or on line of the target?
A drop down menu appears.
Left
Right
On Line
Question 17
User has binoculars
User does not have binoculars
Using your hand at arms length, how far to the right (or left) of the target did the round land?
A drop down menu appears.
One Finger
Two Fingers
Three Fingers
Four Fingers
Fist from knuckle to knuckle
Full outstretched hand from pinky to thumb
The UFO Translator will convert to mils.
Question 18
Using the binos, how many tic marks to the right (or left) of the target did the round land?
A number pad appears so the user can type the number.
Question 18
Please send this correction to the FDC:
"Left [or right] _____ (deviation in meters), add [or drop] _____ (range correction in meters; 400 meters is standard), over."
Please wait for the FDC to read this back before continuing…..
Question 19
Please wait for the FDC to say, "Shot, over," and then immediately say:
"Shot, out."
Question 20

The UFO Translator continues to help users make spottings and corrections in this manner until effects on target are achieved.

Question 21

Once effects on target have been achieved (target hit, range correct spotting, or the next range correction is add/drop 50), please give this correction to the FDC:

"Left [or right] _____ (deviation in meters), add [or drop] _____ (range correction in meters), Fire for Effect, over."

Question 22

What happened to the target?

A drop down menu appears.

Destroyed

Neutralized

Suppressed

No Effect

Question 23

About how many casualties were there?

A number pad appears so the user can type the estimated number of casualties.

Question 24

Please give the following information to the FDC:

"End of Mission, _____ (target description) destroyed/neutralized/suppressed, estimate _____ casualties, over."

Please wait for the FDC to read this back.

This concludes the Fire Mission.

Question 25

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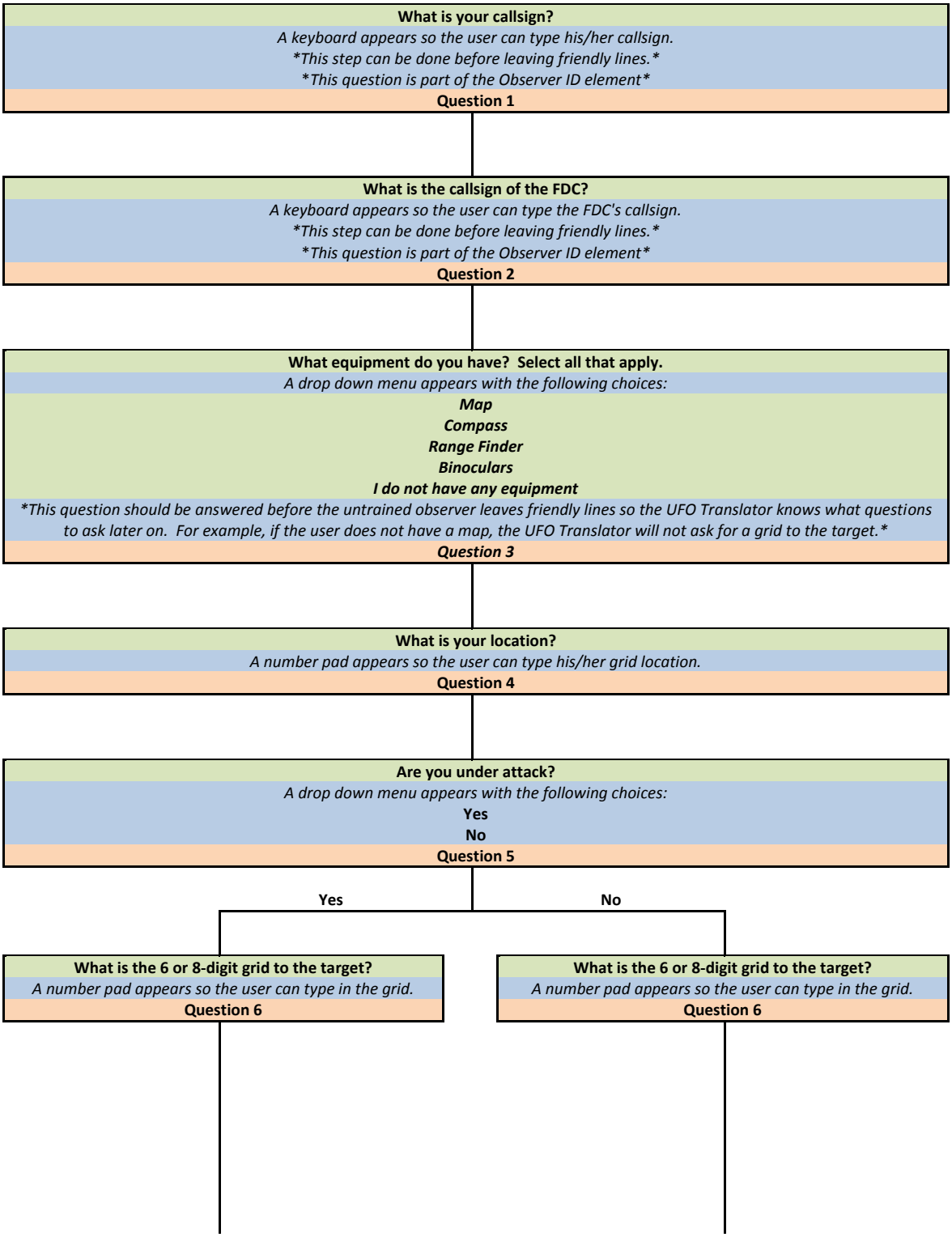
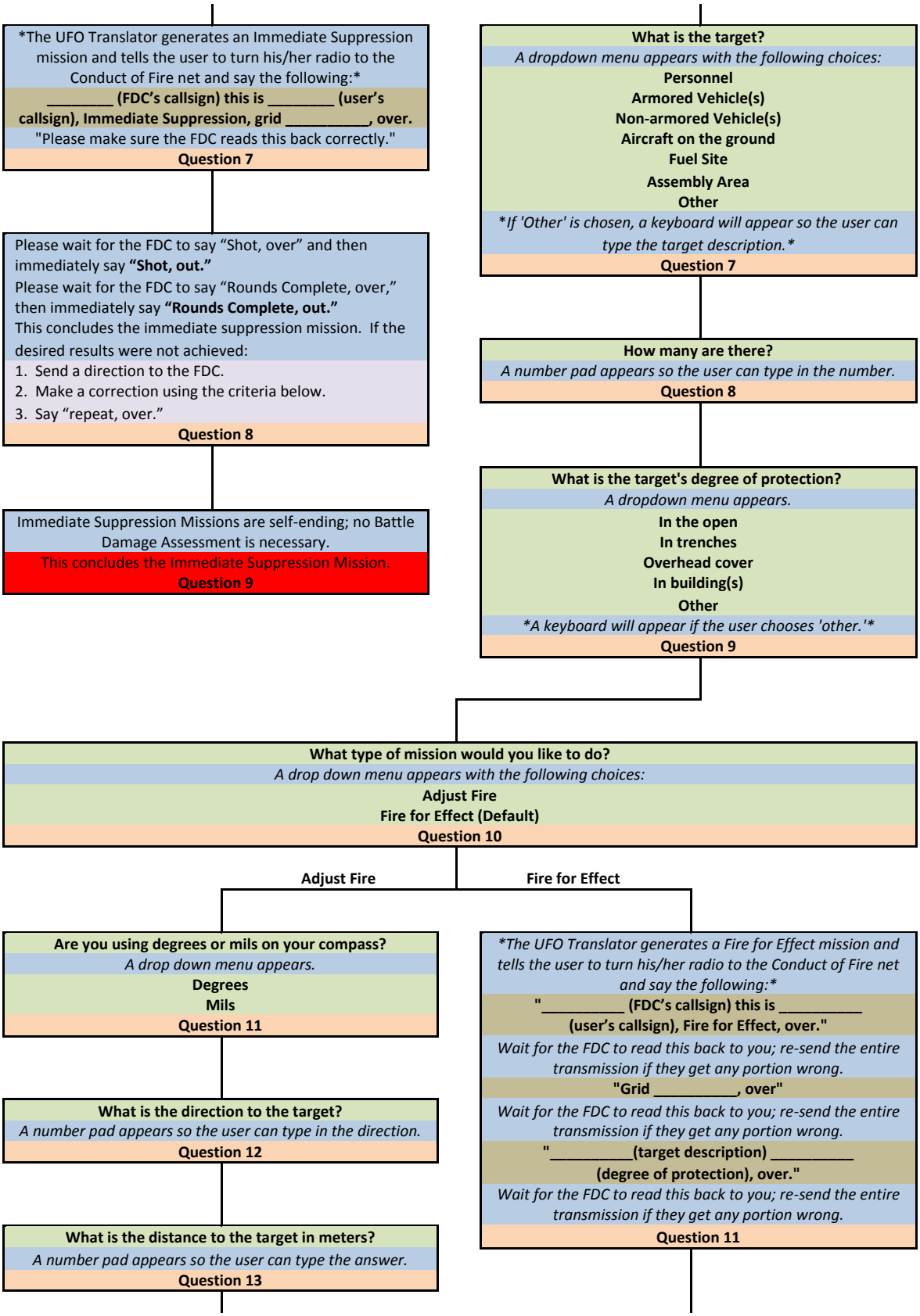
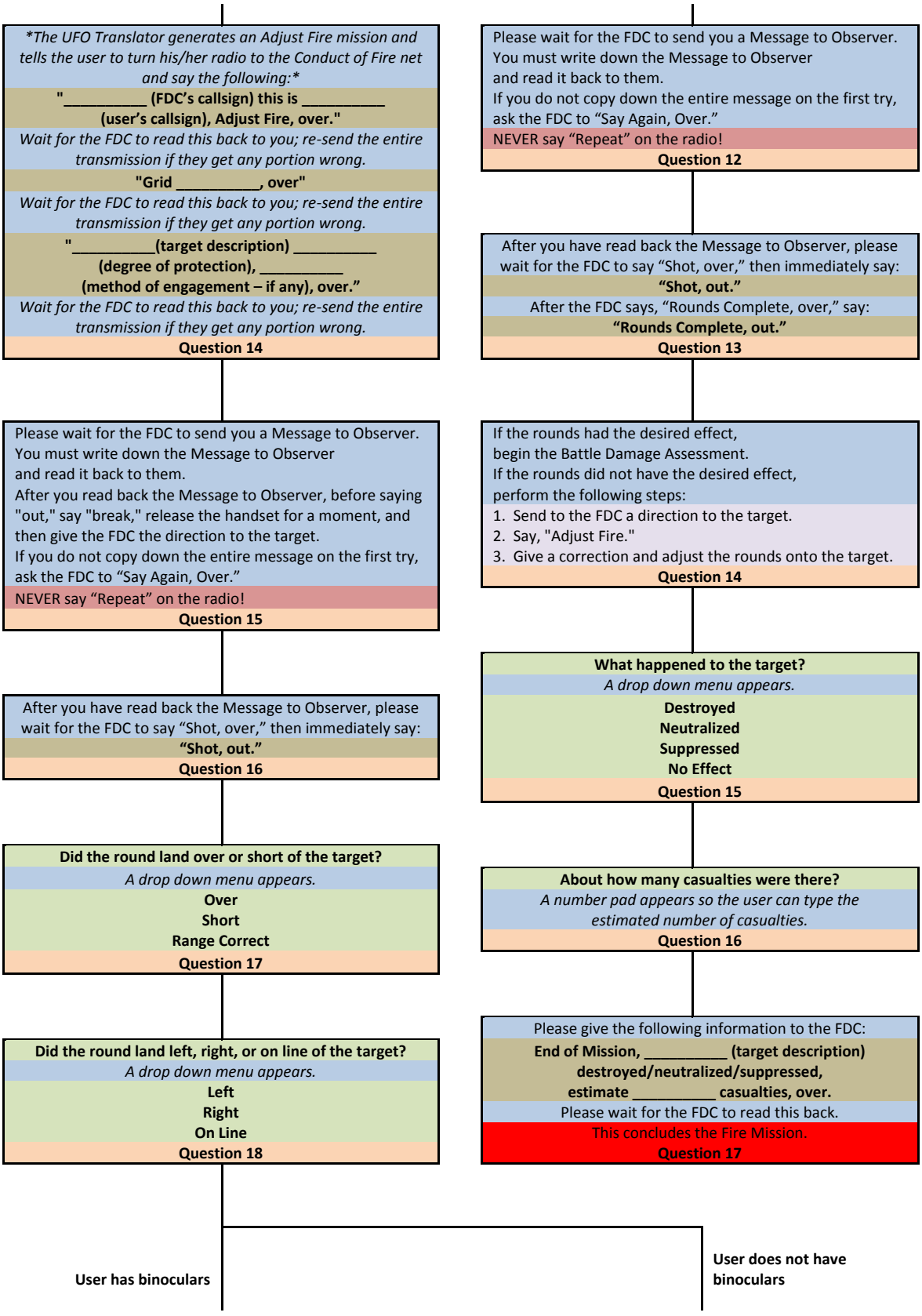
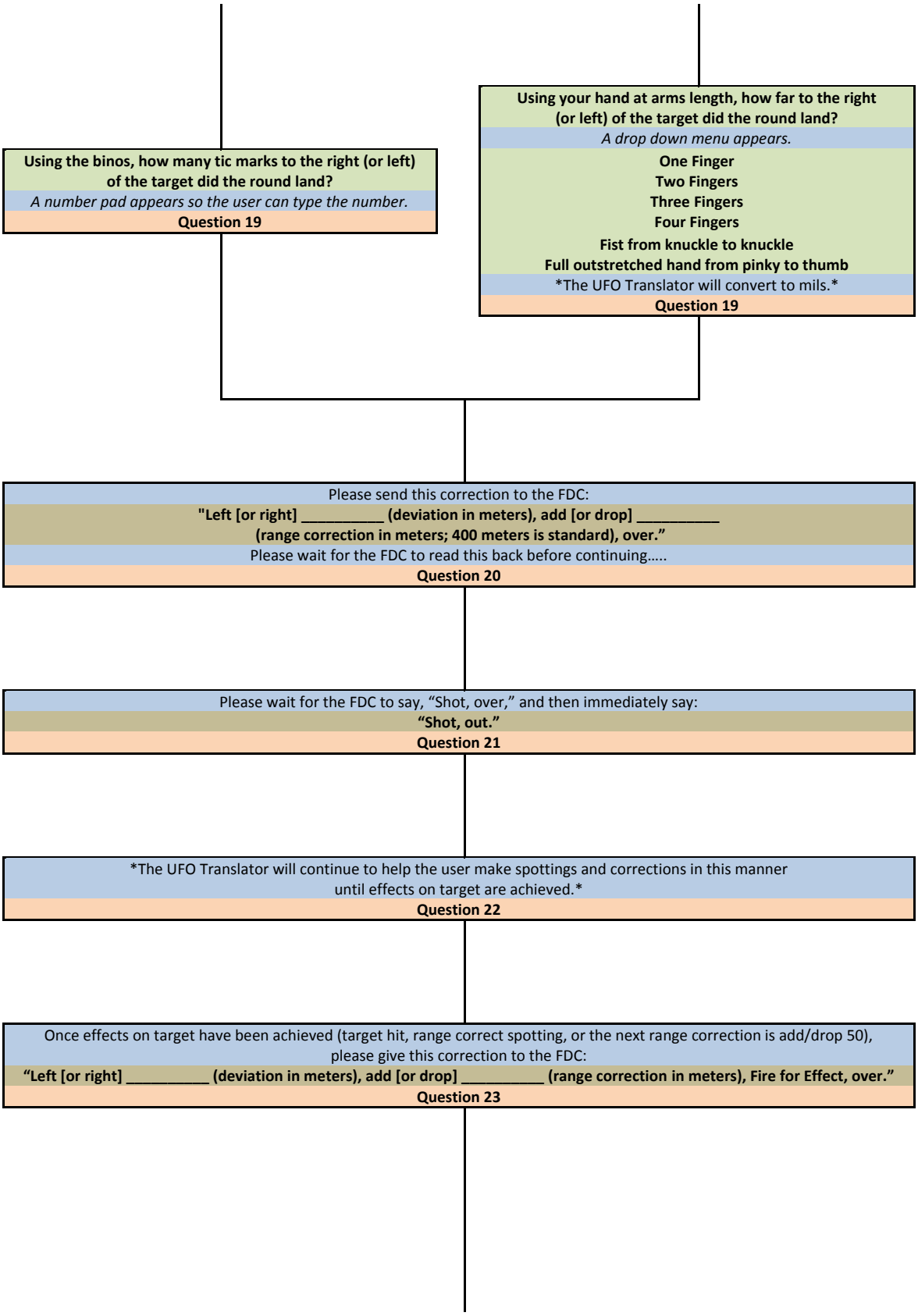
APPENDIX H. LOGIC TREE—USER HAS A MAP, COMPASS, AND RANGE FINDER




The UFO Translator generates an Immediate Suppression mission and tells the user to turn his/her radio to the Conduct of Fire net and say the following:
_____ (FDC's callsign) this is _____ (user's callsign), Immediate Suppression, grid _____, over.
"Please make sure the FDC reads this back correctly."
Question 7
Please wait for the FDC to say "Shot, over" and then immediately say "Shot, out."
Please wait for the FDC to say "Rounds Complete, over," then immediately say "Rounds Complete, out."
This concludes the immediate suppression mission. If the desired results were not achieved:
1. Send a direction to the FDC.
2. Make a correction using the criteria below.
3. Say "repeat, over."
Question 8
Immediate Suppression Missions are self-ending; no Battle Damage Assessment is necessary.
This concludes the Immediate Suppression Mission.
Question 9
What is the target?
A dropdown menu appears with the following choices:
Personnel
Armored Vehicle(s)
Non-armored Vehicle(s)
Aircraft on the ground
Fuel Site
Assembly Area
Other
If 'Other' is chosen, a keyboard will appear so the user can type the target description.
Question 7
How many are there?
A number pad appears so the user can type in the number.
Question 8
What is the target's degree of protection?
A dropdown menu appears.
In the open
In trenches
Overhead cover
In building(s)
Other
A keyboard will appear if the user chooses 'other.'
Question 9
What type of mission would you like to do?
A drop down menu appears with the following choices:
Adjust Fire
Fire for Effect (Default)
Question 10
Adjust Fire
Fire for Effect
Are you using degrees or mils on your compass?
A drop down menu appears.
Degrees
Mils
Question 11
What is the direction to the target?
A number pad appears so the user can type in the direction.
Question 12
What is the distance to the target in meters?
A number pad appears so the user can type the answer.
Question 13
The UFO Translator generates a Fire for Effect mission and tells the user to turn his/her radio to the Conduct of Fire net and say the following:
"_____ (FDC's callsign) this is _____ (user's callsign), Fire for Effect, over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"Grid _____, over"
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"_____(target description) _____ (degree of protection), over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
Question 11


The UFO Translator generates an Adjust Fire mission and tells the user to turn his/her radio to the Conduct of Fire net and say the following:
"_____ (FDC's callsign) this is _____ (user's callsign), Adjust Fire, over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"Grid _____, over"
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"_____(target description) _____ (degree of protection), _____ (method of engagement – if any), over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
Question 14
Please wait for the FDC to send you a Message to Observer.
You must write down the Message to Observer and read it back to them.
If you do not copy down the entire message on the first try, ask the FDC to "Say Again, Over."
NEVER say "Repeat" on the radio!
Question 12
After you have read back the Message to Observer, please wait for the FDC to say "Shot, over," then immediately say:
"Shot, out."
After the FDC says, "Rounds Complete, over," say:
"Rounds Complete, out."
Question 13
Please wait for the FDC to send you a Message to Observer.
You must write down the Message to Observer and read it back to them.
After you read back the Message to Observer, before saying "out," say "break," release the handset for a moment, and then give the FDC the direction to the target.
If you do not copy down the entire message on the first try, ask the FDC to "Say Again, Over."
NEVER say "Repeat" on the radio!
Question 15
If the rounds had the desired effect, begin the Battle Damage Assessment.
If the rounds did not have the desired effect, perform the following steps:
1. Send to the FDC a direction to the target.
2. Say, "Adjust Fire."
3. Give a correction and adjust the rounds onto the target.
Question 14
After you have read back the Message to Observer, please wait for the FDC to say "Shot, over," then immediately say:
"Shot, out."
Question 16
What happened to the target?
A drop down menu appears.
Destroyed
Neutralized
Suppressed
No Effect
Question 15
Did the round land over or short of the target?
A drop down menu appears.
Over
Short
Range Correct
Question 17
About how many casualties were there?
A number pad appears so the user can type the estimated number of casualties.
Question 16
Did the round land left, right, or on line of the target?
A drop down menu appears.
Left
Right
On Line
Question 18
Please give the following information to the FDC:
End of Mission, _____ (target description) destroyed/neutralized/suppressed, estimate _____ casualties, over.
Please wait for the FDC to read this back.
This concludes the Fire Mission.
Question 17
User has binoculars
User does not have binoculars


Using your hand at arms length, how far to the right (or left) of the target did the round land?
A drop down menu appears.
One Finger
Two Fingers
Three Fingers
Four Fingers
Fist from knuckle to knuckle
Full outstretched hand from pinky to thumb
The UFO Translator will convert to mils.
Question 19
Using the binos, how many tic marks to the right (or left) of the target did the round land?
A number pad appears so the user can type the number.
Question 19
Please send this correction to the FDC:
"Left [or right] _____ (deviation in meters), add [or drop] _____ (range correction in meters; 400 meters is standard), over."
Please wait for the FDC to read this back before continuing…..
Question 20
Please wait for the FDC to say, "Shot, over," and then immediately say:
"Shot, out."
Question 21
The UFO Translator will continue to help the user make spottings and corrections in this manner until effects on target are achieved.
Question 22
Once effects on target have been achieved (target hit, range correct spotting, or the next range correction is add/drop 50), please give this correction to the FDC:
"Left [or right] _____ (deviation in meters), add [or drop] _____ (range correction in meters), Fire for Effect, over."
Question 23


What happened to the target?
A drop down menu appears.
Destroyed
Neutralized
Suppressed
No Effect
Question 24
About how many casualties were there?
A number pad appears so the user can type the estimated number of casualties.
Question 25
Please give the following information to the FDC:
"End of Mission, _____ (target description) destroyed/neutralized/suppressed, estimate _____ casualties, over."
Please wait for the FDC to read this back.
This concludes the Fire Mission.
Question 26

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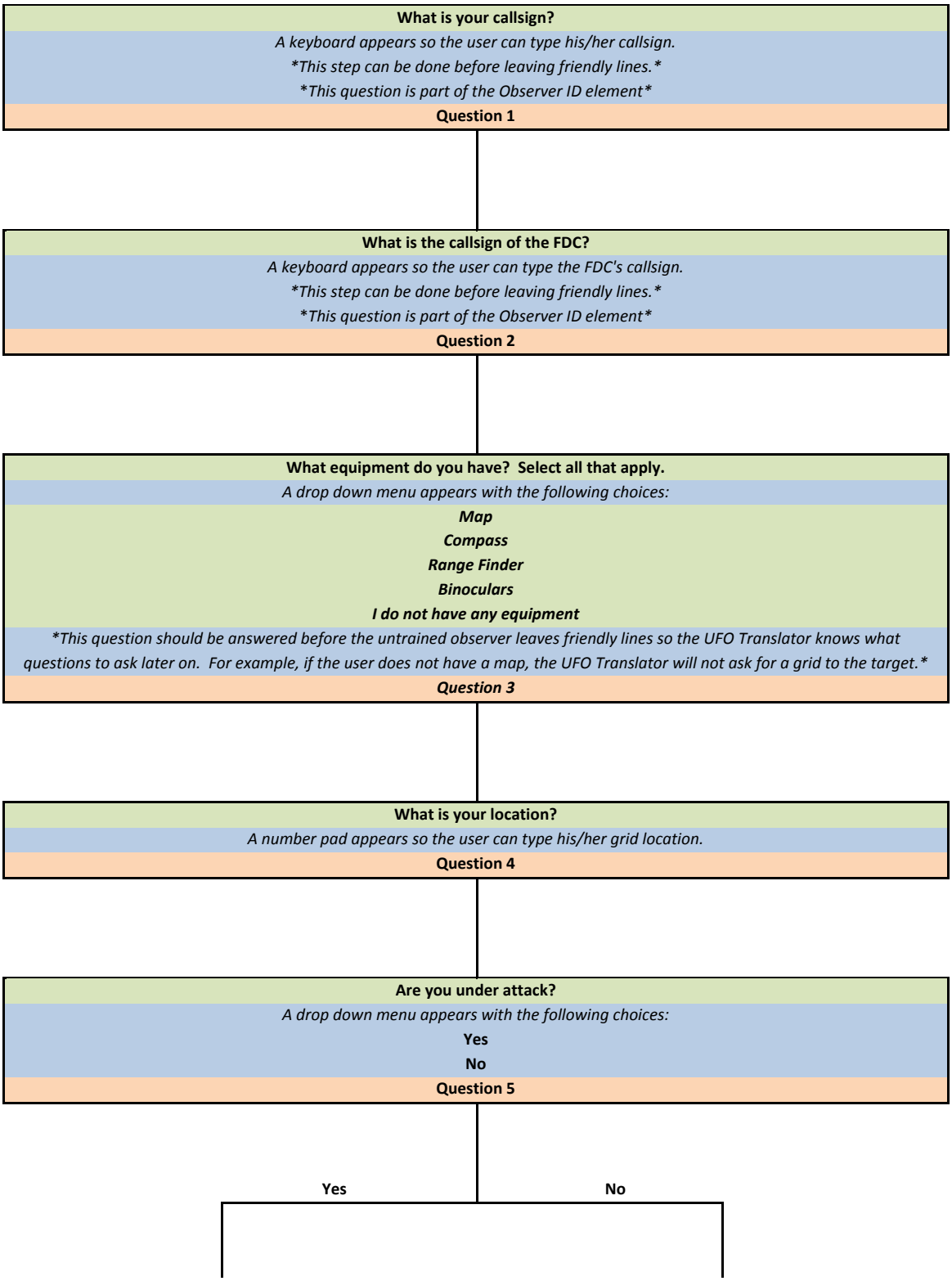
APPENDIX I. LOGIC TREE—USER HAS NO EQUIPMENT



What is the direction to the target?

Since the user has no compass, a drop down menu appears with the following choices:

N, S, E, W, NE, NW, SE, SW

The UFO Translator converts these into mils.

Question 6

About how many football fields away is the target?

*A number pad appears so the user can type the answer. *The UFO Translator converts this number into meters and uses it as the distance to the target.**

Question 7

The UFO Translator generates an Immediate Suppression mission and tells the user to turn his/her radio to the Conduct of Fire net and say the following:

"_____ (FDC's callsign) this is _____ (user's callsign), Immediate Suppression, Polar, Direction _____, Distance _____, over."

"Please make sure the FDC reads this back correctly."

Question 8

Please wait for the FDC to say "Shot, over" and then immediately say **"Shot, out."**

Please wait for the FDC to say "Rounds Complete, over" and then immediately say **"Rounds Complete, out."**

This concludes the immediate suppression mission. If the desired results were not achieved:

1. Send a direction to the FDC.
2. Make a correction using the criteria below.
3. Say "repeat, over."

Question 9

Immediate Suppression Missions are self-ending; no Battle Damage Assessment is necessary.

This concludes the Immediate Suppression Mission.

Question 10

What is the direction to the target?

Since the user has no compass, a drop down menu appears with the following choices:

N, S, E, W, NE, NW, SE, SW

The UFO Translator converts these into mils.

Question 6

About how many football fields away is the target?

*A number pad appears so the user can type the answer. *The UFO Translator converts this number into meters and uses it as the distance to the target.**

Question 7

What is the target?

A dropdown menu appears with the following choices:

Personnel
Armored Vehicle(s)
Non-armored Vehicle(s)
Aircraft on the ground
Fuel Site
Assembly Area
Other

If "Other" is chosen, a keyboard will appear so the user can type the target description.

Question 8

How many are there?

A number pad appears so the user can type in the number.

Question 9

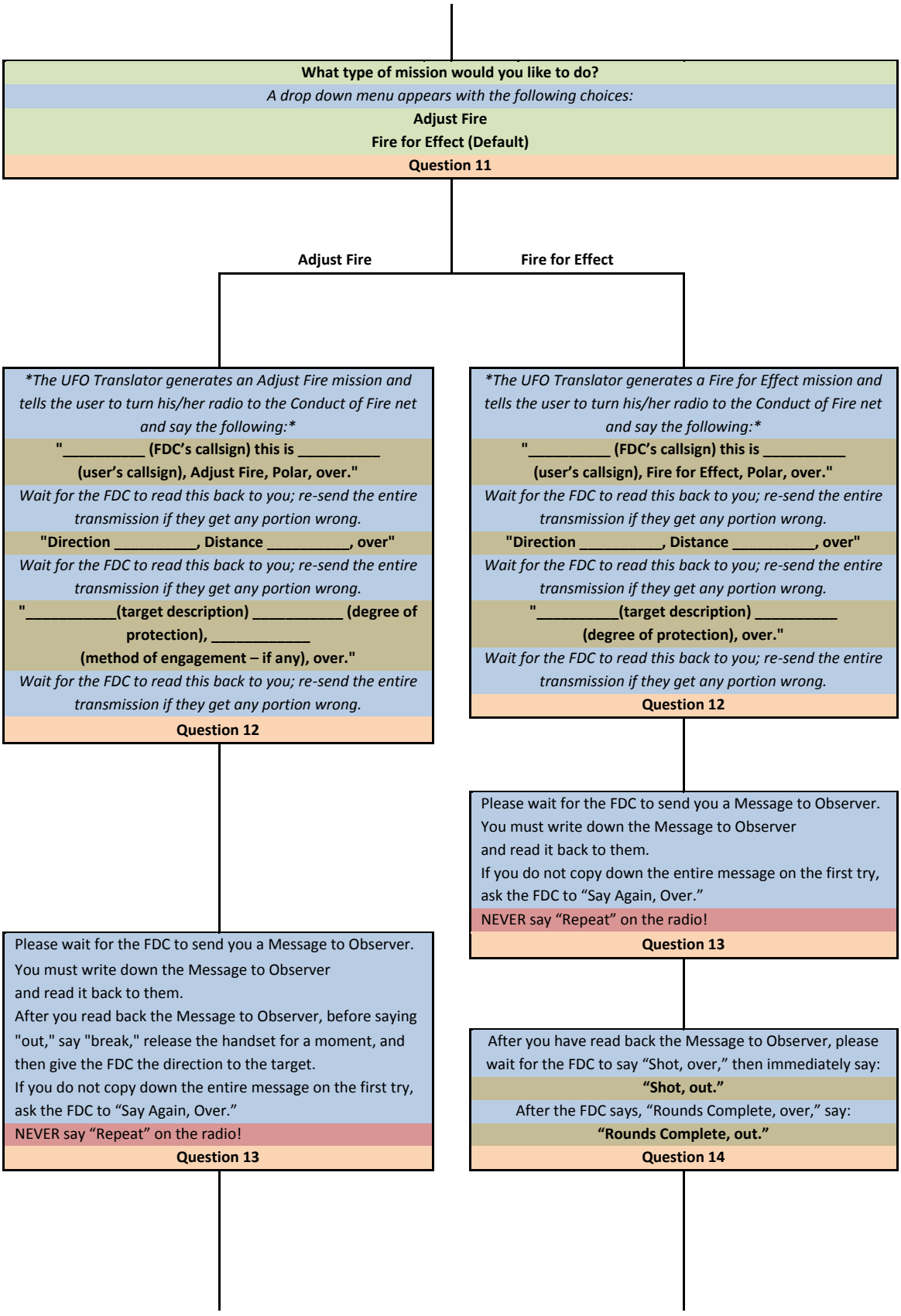
What is the target's degree of protection?

A dropdown menu appears.

In the open
In trenches
Overhead Cover
In building(s)
Other

A keyboard will appear if the user chooses "Other."

Question 10


What type of mission would you like to do?
A drop down menu appears with the following choices:
Adjust Fire
Fire for Effect (Default)
Question 11
Adjust Fire
Fire for Effect
The UFO Translator generates an Adjust Fire mission and tells the user to turn his/her radio to the Conduct of Fire net and say the following:
"_____ (FDC's callsign) this is _____ (user's callsign), Adjust Fire, Polar, over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"Direction _____, Distance _____, over"
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"_____(target description) _____ (degree of protection), _____ (method of engagement – if any), over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
Question 12
The UFO Translator generates a Fire for Effect mission and tells the user to turn his/her radio to the Conduct of Fire net and say the following:
"_____ (FDC's callsign) this is _____ (user's callsign), Fire for Effect, Polar, over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"Direction _____, Distance _____, over"
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
"_____(target description) _____ (degree of protection), over."
Wait for the FDC to read this back to you; re-send the entire transmission if they get any portion wrong.
Question 12
Please wait for the FDC to send you a Message to Observer.
You must write down the Message to Observer and read it back to them.
After you read back the Message to Observer, before saying "out," say "break," release the handset for a moment, and then give the FDC the direction to the target.
If you do not copy down the entire message on the first try, ask the FDC to "Say Again, Over."
NEVER say "Repeat" on the radio!
Question 13
Please wait for the FDC to send you a Message to Observer.
You must write down the Message to Observer and read it back to them.
If you do not copy down the entire message on the first try, ask the FDC to "Say Again, Over."
NEVER say "Repeat" on the radio!
Question 13
After you have read back the Message to Observer, please wait for the FDC to say "Shot, over," then immediately say:
"Shot, out."
After the FDC says, "Rounds Complete, over," say:
"Rounds Complete, out."
Question 14

After you have read back the Message to Observer, please wait for the FDC to say "Shot, over," then immediately say:

"Shot, out."

Question 14

Did the round land over or short of the target?

A drop down menu appears.

Over

Short

Range Correct

Question 15

Did the round land left, right, or on line of the target?

A drop down menu appears.

Left

Right

On Line

Question 16

User has binoculars

Using the binos, how many tic marks to the right (or left) of the target did the round land?

A number pad appears so the user can type the number.

Question 17

If the rounds had the desired effect, begin the Battle Damage Assessment.
If the rounds did not have the desired effect, perform the following steps:

1. Send to the FDC a direction to the target.
2. Say, "Adjust Fire."
3. Give a correction and adjust the rounds onto the target.

Question 15

What happened to the target?

A drop down menu appears.

Destroyed

Neutralized

Suppressed

No Effect

Question 16

About how many casualties were there?

A number pad appears so the user can type the estimated number of casualties.

Question 17

Please give the following information to the FDC:

End of Mission, _____ (target description) destroyed/neutralized/suppressed, estimate _____ casualties, over.

Please wait for the FDC to read this back.

This concludes the Fire Mission.

Question 18

User does not have binoculars

Using your hand at arms length, how far to the right (or left) of the target did the round land?

A drop down menu appears.

One Finger

Two Fingers

Three Fingers

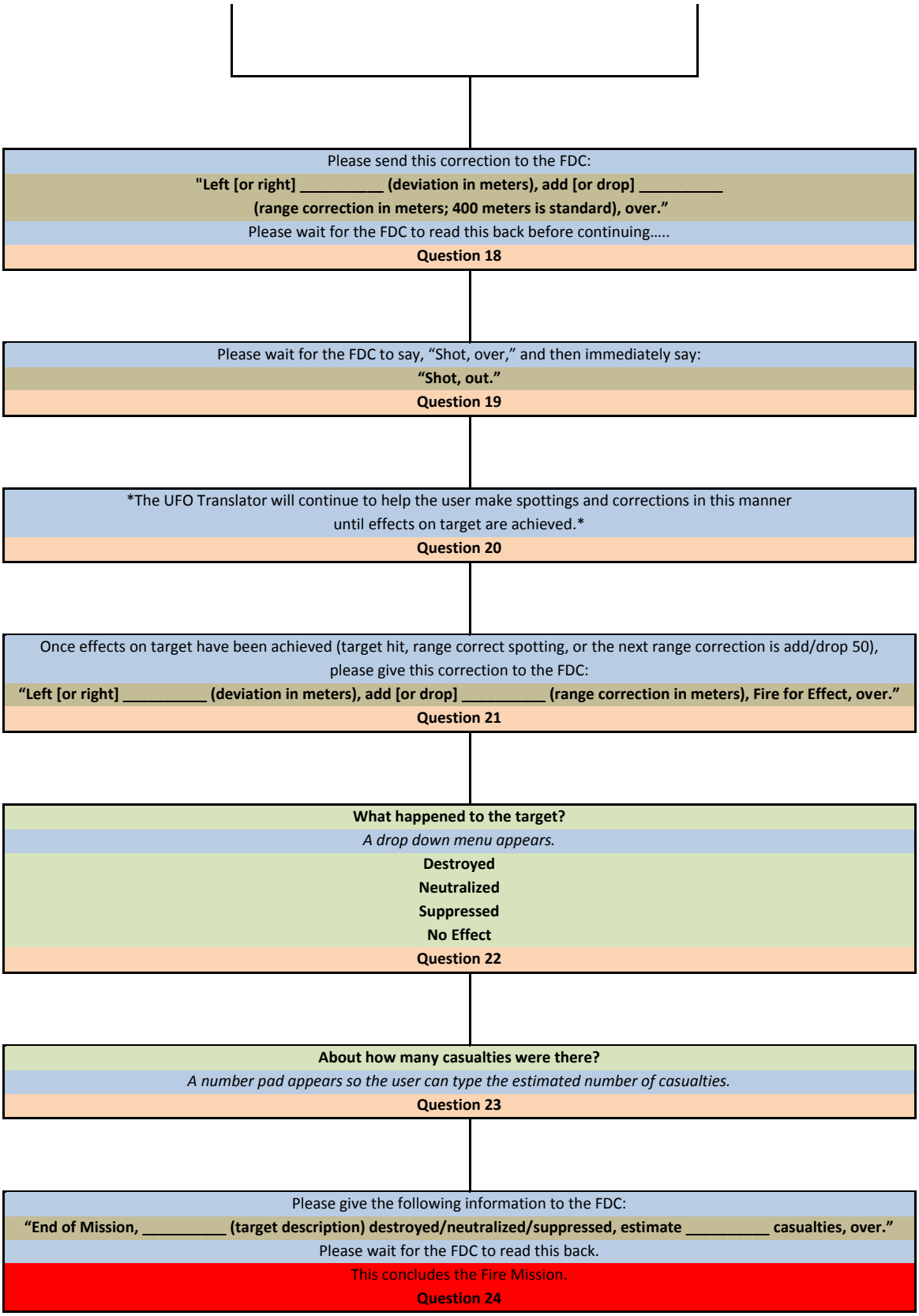
Four Fingers

Fist from knuckle to knuckle

Full outstretched hand from pinky to thumb

The UFO Translator will convert to mils.

Question 17


Please send this correction to the FDC:
"Left [or right] _____ (deviation in meters), add [or drop] _____
(range correction in meters; 400 meters is standard), over."
Please wait for the FDC to read this back before continuing…..
Question 18
Please wait for the FDC to say, "Shot, over," and then immediately say:
"Shot, out."
Question 19
*The UFO Translator will continue to help the user make spottings and corrections in this manner
until effects on target are achieved.*
Question 20
Once effects on target have been achieved (target hit, range correct spotting, or the next range correction is add/drop 50),
please give this correction to the FDC:
"Left [or right] _____ (deviation in meters), add [or drop] _____ (range correction in meters), Fire for Effect, over."
Question 21
What happened to the target?
A drop down menu appears.
Destroyed
Neutralized
Suppressed
No Effect
Question 22
About how many casualties were there?
A number pad appears so the user can type the estimated number of casualties.
Question 23
Please give the following information to the FDC:
"End of Mission, _____ (target description) destroyed/neutralized/suppressed, estimate _____ casualties, over."
Please wait for the FDC to read this back.
This concludes the Fire Mission.
Question 24

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